COMPUTER SCIENCE AND ENGINEERING

LIST OF COURSES

Sl.No	Course Code	Course Name	Credits
1	17CS3082	Software Defined Networks	3:0:0
2	18CS1001	Information and Communication Technology	1:0:1
3	18CS2001	Basics of Computer Programming	3:0:1

S.N.	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	18CS1002	Programming for Problem Solving Lab	0	0	3	1.5
2	18CS1003	Fundamentals of Computer Programming Lab	0	0	2	1
3	18CS1004	Programming for Problem Solving	3	0	0	3
4	18CS2002	Computer Networks	3	0	0	3
5	18CS2003	Computer Networks Lab	0	0	4	2
6	18CS2004	Computer Organization and Architecture	3	0	0	3
7	18CS2005	Cryptography and Network Security	3	0	0	3
8	18CS2006	Data Structure and Algorithms	3	0	0	3
9	18CS2007	Data Structure and Algorithms Lab	0	0	4	2
10	18CS2008	Database Management Systems	3	0	0	3
11	18CS2009	Database Management Systems Lab	0	0	4	2
12	18CS2010	Design and Analysis of Algorithms	3	0	0	3
13	18CS2011	Design and Analysis of Algorithms Lab	0	0	4	2
14	18CS2012	Fabrication Testing and Troubleshooting Lab	0	0	4	2
15	18CS2013	Machine Learning Techniques	3	0	0	3
16	18CS2014	Object Oriented Programming	3	0	0	3
17	18CS2015	Object Oriented Programming Lab	0	0	4	2
18	18CS2016	Operating Systems	3	0	0	3
19	18CS2017	Operating Systems Lab	0	0	4	2
20	18CS2018	Software Engineering	3	0	0	3
21	18CS2019	System Software and Compiler Design	3	0	0	3
22	18CS2020	System Software and Compiler Lab	0	0	4	2
23	18CS2021	Theory of Computation	3	0	0	3
24	18CS2022	Web Technology	3	0	0	3
25	18CS2023	Web Technology Lab	0	0	4	2
26	18CS2024	Artificial Intelligence	3	0	0	3
27	18CS2921	Comprehensive Practices	0	0	3	1.5
28	18CS3001	Advanced Algorithms	3	0	0	3
29	18CS3002	Advanced Computer Networks	3	0	0	3
30	18CS3003	Advanced Computer Networks Lab	0	0	4	2
31	18CS3004	Advanced Cryptography and Network Security	3	0	0	3
32	18CS3005	Advanced Data Structures	3	0	0	3

33	18CS3006	Advanced Data Structures and Algorithms Lab	0	0	4	2
34	18CS3007	Advanced Database Management Systems	3	0	0	3
35	18CS3008	Advanced Database Management Systems Lab	0	0	4	2
36	18CS3009	Advanced Machine Learning	3	0	0	3
37	18CS3010	Advanced Web Technology	3	0	0	3
38	18CS3011	Advanced Web Technology Lab	0	0	4	2
39	18CS3012	Advanced Wireless and Mobile Networks	3	0	0	3
40	18CS3013	Big Data Analytics	3	0	0	3
41	18CS3014	Biometrics	3	0	0	3
42	18CS3015	Cloud Computing	3	0	0	3
43	18CS3016	Cloud Computing and IOT	3	0	0	3
44	18CS3017	Cloud Security	3	0	0	3
45	18CS3018	Cloud Simulation Lab	0	0	4	2
46	18CS3019	Cluster and Grid Computing	3	0	0	3
47	18CS3020	Cognitive Wireless Network	3	0	0	3
48	18CS3021	Compiler for HPC	3	0	0	3
49	18CS3022	Computer Networks and IoT	3	0	0	3
50	18CS3023	Computer Vision	3	0	0	3
51	18CS3024	Computing Security Lab	0	0	4	2
52	18CS3025	Concurrence Parallelism and Distributed System	3	0	0	3
53	18CS3026	Cyber Forensics	3	0	0	3
54	18CS3027	Cyber Physical Systems	3	0	0	3
55	18CS3028	Data Center Networking	3	0	0	3
56	18CS3029	Data Encryption and Compression	3	0	0	3
57	18CS3030	Data Preparation and Analysis	3	0	0	3
58	18CS3031	Data Science	3	0	0	3
59	18CS3032	Data Science Lab	0	0	4	2
60	18CS3033	Data Visualization	3	0	0	3
61	18CS3034	Data Warehouse and Data Mining	3	0	0	3
62	18CS3035	Database Security and Access Control	3	0	0	3
63	18CS3036	Design and Analysis of Networks	3	0	0	3
64	18CS3037	Design and Analysis of Networks Lab	0	0	4	2
65	18CS3038	Digital Forensics	3	0	0	3
66	18CS3039	Distributed Databases	3	0	0	3
67	18CS3040	Distributed Systems	3	0	0	3
68	18CS3041	DNA computing	3	0	0	3
69	18CS3042	Ethical Hacking	3	0	0	3
70	18CS3043	GPU Computing	3	0	0	3
71	18CS3044	High Performance Computing	3	0	0	3
72	18CS3045	High Performance Scientific Computing	3	0	0	3

73	18CS3046	High Speed Networks	3	0	0	3
74	18CS3047	HPC Architecture and Ecosystem	3	0	0	3
75	18CS3048	Human Centered Computing	3	0	0	3
76	18CS3049	Human Computer Interaction	3	0	0	3
77	18CS3050	Information Theory and Coding	3	0	0	3
78	18CS3051	Intelligent Systems	3	0	0	3
79	18CS3052	Internet of Things	3	0	0	3
80	18CS3053	Internet of Things Security	3	0	0	3
81	18CS3054	Internetworking with TCP/IP	3	0	0	3
82	18CS3055	IoT and Smart Cities	3	0	0	3
83	18CS3056	IoT Application and Communication Protocol	3	0	0	3
84	18CS3057	Knowledge Discovery	3	0	0	3
85	18CS3058	Logic and Functional Programming	3	0	0	3
86	18CS3059	Machine Learning	3	0	0	3
87	18CS3060	Malware Analysis and Reverse Engineering	3	0	0	3
88	18CS3061	Mobile AdHoc Network	3	0	0	3
89	18CS3062	Mobile Applications and Services	3	0	0	3
90	18CS3063	Mobile Computing and Communication	3	0	0	3
91	18CS3064	Multimedia Networks	3	0	0	3
92	18CS3065	Network Management	3	0	0	3
93	18CS3066	Network Programming	3	0	0	3
94	18CS3067	Network Security	3	0	0	3
95	18CS3068	Network Virtualization	3	0	0	3
96	18CS3069	Operating System Design	3	0	0	3
97	18CS3070	Optimization Techniques	3	0	0	3
98	18CS3071	Parallel Algorithms	3	0	0	3
99	18CS3072	Parallel Programming Tools and Models	3	0	0	3
100	18CS3073	Penetration Testing and Vulnerability Analysis	3	0	0	3
101	18CS3074	Quantum Computing	3	0	0	3
102	18CS3075	Recommender System	3	0	0	3
103	18CS3076	Routing Algorithms	3	0	0	3
104	18CS3077	Secure coding	3	0	0	3
105	18CS3078	Secure Software Design and Enterprise Computing	3	0	0	3
106	18CS3079	Security and Privacy for Big Data	3	0	0	3
107	18CS3080	Security Assessment and Risk Analysis	3	0	0	3
108	18CS3081	Security in Computing	3	0	0	3
109	18CS3082	Sensor Networks and Internet of Things	3	0	0	3
110	18CS3083	Sensors and Internet of Things Lab	0	0	4	2
111	18CS3084	Smart Sensors and Internet of Things	3	0	0	3
112	18CS3085	Soft Computing	3	0	0	3

113	18CS3086	Soft Computing Lab	0	0	4	2
114	18CS3087	Steganography and Digital Watermarking	3	0	0	3
115	18CS3088	Storage Area Networks	3	0	0	3
116	18CS3089	Storage Technologies and Networks	3	0	0	3
117	18CS3090	Threaded and Message-Passing Programming	3	0	0	3
118	18CS3091	Web Analytics and Development	3	0	0	3
119	18CS3092	Web Application Security	3	0	0	3
120	18CS3093	Web Search and Information Retrieval	3	0	0	3
121	18CS3094	Wireless Access Technologies	3	0	0	3
122	18CS3095	Wireless and Mobile Networks	3	0	0	3
123	18CS3096	Wireless LAN	3	0	0	3
124	18CS3097	Wireless Local and Personal Area Networks	3	0	0	3
125	18CS3098	Wireless Network Lab	0	0	4	2
126	18CS3099	Wireless Network Security	3	0	0	3
127	18CS3100	Wireless Sensor Networks	3	0	0	3

17CS3082 SOFTWARE DEFINED NETWORKS

Credit: 3:0:0

Objectives:

Enable the student to

- understand the fundamental concepts of SDN.
- express the ways to program the switches used in modern data networks.
- describe SDN controllers, data center and virtualization.

Outcomes:

The student will be able to

- summarize the basic concepts of SDN.
- explain the SDN network architecture.
- discuss the Open Flow model.
- analyze the features of various SDN controllers.
- describe the functioning of data center and techniques around virtualization.
- develop an SDN framework for running various applications.

Unit I - Introduction: Evolution of Switches and Control Planes -SDN Implications for Research and Innovation - Data Center Innovation and Needs - The Genesis of SDN - How SDN Works.

Unit II - Open Flow and SDN Controllers: Open Flow Specification: Overview - Basics - Additions - Limitations - SDN Controllers- General concepts.

Unit III - SDN in the Data Center and Other Environments: Definition -Demands -Tunneling Technologies - Path Technologies - Ethernet Fabrics - SDN Use Cases- Open SDN versus Overlays - Real-World Implementations - SDN in other Environments.

Unit IV - Network Function Virtualization: Introduction - Virtualization and Data Plane I/O - Services Engineered Path - Service Locations and Chaining, NFV at ETSI, Non-ETSI NFV Work.

Unit V - Building an SDN Framework: Introduction, Build Code First - The Juniper SDN Framework - IETF SDN Framework(s) - Open Daylight Controller/Framework - Policy -SDN Applications.

Reference Books:

1. Paul Goransson and Chuck Black, Morgan Kaufmann, Software Defined Networks: A Comprehensive Approach, June 2014, ISBN: 9780124166752.

2. Thomas D. Nadeau, Ken Gray, SDN: Software Defined Networks, An Authoritative Review of Network Programmability Technologies, Publisher: O'Reilly Media, August 2013, ISBN: 9781-4493-4230-2, ISBN 10: 1-4493-4230-2.
3. Fei Hu, Network Innovation through OpenFlow and SDN: Principles and Design,CRC Press, 2014, ISBN-10:1466572094.
4. Doug Marschke, Jeff Doyle, Pete Moyer, Software Defined Networking (SDN): Anatomy of OpenFlow Volume I, Lulu Publishing Services (March 25, 2015), ISBN-10: 1483427234,ISBN-13: 978-1483427232.
5. Open Networking Foundation (ONF) Documents, https://www.opennetworking.org, 2017.

18CS1001 INFORMATION AND COMMUNICATION TECHNOLOGY

Credits: 1:0:1

Course Objective:

Enable the student to

- understand the fundamentals of acquiring different forms of data
- know the processing of numerical and textual data
- understand the concepts of multimedia

Course Outcome:

The student will be able to

- Classify different forms of data
- Acquire different forms of data
- Analyze the working of hardware and software
- Organize the data
- Work on technologies related to multimedia and Internet

Course Description:

Data and Information – Acquisition of Numbers and Textual Data. Acquiring Image Data – Acquiring Video Data – Acquisition of Video - Data Storage Computer Networks – Output Devices. Central Processing Unit – Computer Software – Data Organization. Processing Numerical Data – Processing and Displaying Textual Data. Multimedia Data – Internet Applications.

Experiments

1. Applications using Excel
2. Applications using GIMP
3. Making of straight-through and cross-over cables
4. Understanding the parts of Computer
5. Applications using Built-in functions in Excel
6. Animation using GIMP

Textbook:

V. Rajaraman, Introduction to Information Technology, Second Edition, 2013, PHI, ISBN: 978-81-203-4731-1.

Reference Books

1. M. LutfarRahaman, M. Shamim Kaiser, M. ArifurRaham, Alamgir Hossain, Computer Fundamentals and ICT, 2016, Daffodil International University Press.
2. Kathy schwalve, Information Technology Project Management, 2013, Course Technology, ISBN:978-1133526858.
3. Brian K. Williams, Stacey Sawyer, Using Information Technology, 11th Edition, 2014, Mc-Graw Hill Education, ISBN: 978-0073516882
4. Eric Frick, Information Technology Essentials: Basic Foundation for Information Technology Professionals, 2017, ISBN: 978-1521576410

5. Joan Lambert, Curtis Frye, Microsoft Office 2016 Step by Step, 1st Edition, Microsoft Press, ISBN: 978-8120352049.

18CS2001 BASICS OF COMPUTER PROGRAMMING

Credits: 3:0:1

Course Objective:

Enable the Student to

- understand the fundamentals of computers and programming
- know about basic programming using C language
- implement programs using structured programming techniques

Course Outcome:

The student will be able to

- Understand the fundamental principles of programming
- Gain knowledge on the concepts of structured programming
- Understand logics of solving problems
- Solve problems using basic programming techniques
- Apply programming to solve real world problems
- Illustrate the role of programming in real life scenarios

Course Description:

Introduction to Computer Software- Classification of Computer Software-Programming Languages-Generation of Programming Languages- Introduction to C: Structure of C program- files used in a C program- Compiling and Executing C programs- Using Comments- C tokens- Character set in C-Keywords-identifiers- basic data types-variables -constants. **Introduction to C:** Input/output statements - Operators-Type conversion and type casting- **Decision Control and Looping Statement:** Introduction to decision control statements-conditional branching statements- Iterative statements-Nested loops-break and continue statements-goto statement. **Functions:** Introduction- Using functions-function declaration/function prototype-function definition-function call-return statement-passing parameters to functions- Scope of variables- Storage classes. **Arrays and Strings:** Introduction- Declaration of arrays-Accessing the elements of an array- Storing values in arrays- two dimensional arrays- Introduction to strings-Operations on strings. **Pointers and Structure:** Understanding the computer's memory-Declaring Pointer Variables - Introduction to Pointers-Pointer Expressions and Pointer Arithmetic -Structure Declaration – Initialization of Structures – Accessing the Members of a Structure – Copying and Comparing Structures – Union – Enumerated Datatype.

Experiments

1. Applications using Nested Loops
2. Applications using Functions
3. Applications using Arrays
4. String manipulation programs
5. Applications using Pointers
6. Applications using Structure

Textbook:

ReemaThareja, "Programming in C", Second Edition, 2016, Oxford Higher Education, ISBN: 978-0-19-945614-7.

Reference Books

1. Anita Goel, Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., 2013, ISBN 978-93-325-1934-3.
2. YashwantKanetkar, "Let us C", 14th Edition, BPB Publications, 2016, ISBN 8183331637.
3. E. Balagurusamy, "Programming in ANSI C", 6th Edition, Tata McGraw Hill, 2012, ISBN 978-1259004612.

4. PradipDey, Manas Ghosh, "Programming in C", 2nd Edition, Oxford University Press, 2016, ISBN: 978-0-19-806528-9.
5. Ashok N. Kamthane, "Fundamentals of Computer Programming", Pearson, 2013, ISBN 978-81-317-0007-5.

18CS1002	Programming for Problem Solving Lab	L	T	P	C
		0	0	3	1.5

Course Objectives:

Enable the student to

1. understand the need for programming to solve computational problems.
2. discover the basic programming constructs to prepare the program.
3. develop applications to solve real time problems.

Course Outcomes:

The student will be able to

1. formulate the algorithms for simple problems
2. translate given algorithms to a working and correct program
3. identify and correct logical errors encountered at run time
4. create iterative as well as recursive programs.
5. represent data in arrays, strings and structures and manipulate them through a program.
6. declare pointers of different types and use them in defining self-referential structures.

List of Experiments:

1. Implementation of Basic C programs
2. Simple computational problems using arithmetic expressions and operators
3. Problem solving using branching and logical expressions
4. Iterative problems using Loops, while and for loops
5. Implementation of linear searching, bubble sort, and Matrix Manipulation using Arrays
6. Implementation of Text Processing using Strings
7. Find Square Root, numerical differentiation, numerical integration using functions and recursion.
8. Problem solving using pointers and dynamic memory allocation
9. Creating user defined types using structures.
10. Implementation of basic file operations

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS1003	Fundamentals of Computer Programming Lab	L	T	P	C
		0	0	2	1

Course Objectives:

Enable the student to

1. understand the necessity for computer programming to solve engineering problems.
2. discover the basic programming constructs to prepare the program.
3. develop applications to solve real time problems.

Course Outcomes:

The student will be able to

1. formulate the algorithms for simple problems
2. translate given algorithms to a executable program
3. identify and troubleshoot the coding
4. create and execute iterative and recursive programs
5. represent data in arrays, strings and structures and manipulate them
6. declare and using various data types and variables

List of Experiments:

1. Implementation of Basic C programs

2. Simple computational problems using arithmetic expressions and operators
3. Problem solving using branching and logical expressions
4. Iterative problems using Loops, while and for loops
5. Implementation of Text Processing using Strings
6. Find Square Root, numerical differentiation, numerical integration using functions and recursion.
7. The faculty conducting the laboratory will prepare the list of experiments, get the approval of the HoD and notify it at the beginning of each semester.

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS1004	Programming for Problem Solving	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. recognize the need for programming languages and problem solving techniques.
2. apply memory management concepts and function based modularization.
3. develop programming skills to solve real time computational problems.

Course Outcomes:

The Student will be able to

1. understand the fundamentals of computer and program development process.
2. identify the memory management to represent the real time data for computation.
3. prepare innovative solution for the problem using branching and looping statements.
4. decompose a problem into functions and synthesize a complete program using divide and conquer approach.
5. formulate algorithms and programs using arrays, pointers and structures
6. create a new application software to solve real world problems.

Module 1: Introduction to Programming

Introduction to computers, Computer characteristics, Hardware vs software, Steps to develop a program, Software development life cycle, Structured programming, Types of programming languages, Introduction to c, Developing a c program, Console input and output functions, Error diagnostics, Debugging techniques.

Module 2: Operators and Expressions

Identifiers and keywords, Data types, Constants, Variables, Declarations, Expressions, Statements, Arithmetic operators, Unary operators, Relational and logical operators, Assignment operators, Conditional operator.

Module 3: Conditional Branching and Loops

Branching, if-else statement, switch statement, goto statement, Looping, while statement, do- while statement, for statement, Nested control structures, break statement, continue statement.

Module 4: Arrays and Strings

Defining an array, Processing an array, Multidimensional arrays, Searching algorithm, Linear search, Sorting algorithm, Bubble sort algorithm, Strings, Defining a string, Initialization of strings, Reading and writing a string, Processing the strings.

Module 5: Functions

Functions, Overview, Defining a function, Accessing a function, Function prototypes, Passing arguments to a function, Passing arrays to functions, Recursion.

Module 6: Pointers and Structures

Fundamentals, Pointer declarations, Passing pointers to functions, Pointers and one dimensional arrays, Dynamic memory allocation, Operations on pointers, Defining a structure, Processing a structure, Array of structures, Structures and pointers, Self-referential structures.

Text Books:

1. Byron Gottfried, "Schaum's Outline of Programming with C", 3rd edition, 2016, McGraw Hill Education (India), ISBN: 9780070145900
2. Balagurusamy, E "Programming in ANSI C", 7th edition, McGraw Higher Ed, 2016, ISBN: 9789339219666

Reference Books:

1. Yashavant Kanetkar, "Let Us C", 15th edition, 2016, Bpb Publications, ISBN:9788183331630
2. Herbert Schildit, "The Complete Reference C", 4th edition, 2017, McGraw Hill Education(India), 2017, ISBN:978007041183
3. Beulah Christalin Latha, Anuja Beatrice, Carolin Jeeva & Anita Sofia, Fundamentals of Computing and Programming, 1st edition, Pearson, 2018
4. Sumitabha Das, "Computer Fundamentals and C Programming", 18th edition, 2018, McGraw Hill Education (India), ISBN:9789387886070
5. Stephen G. Kochan, "Programming in C", 4th edition, 2015, ISBN: 9789332554665,
6. David Griffiths, "Head First C", 1st edition, 2012, O'Reilly Media, ISBN:978-1449399917

18CS2002	Computer Networks	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the protocol layers and their service models.
2. compare and analyze connectionless and connection oriented transport protocols.
3. manage the network infrastructure.

Course Outcomes:

The student will be able to

1. describe the protocol layers, Internet protocol and their service models.
2. identify the factors influencing computer network infrastructure and development.
3. apply the network protocols in building the computer networks.
4. analyze the routing algorithms and their behaviors.
5. design computer networks with optimized address assignment.
6. evaluate the performance and characteristics of network protocols.

Module 1: Overview

Protocol, Physical media, Packet switching, Circuit switching, Delay, loss and throughput, Network topology, Protocols and standards, OSI model, Connecting LAN and virtual LAN

Module 2: Application layer

Principles of network applications, Web and HTTP, File transfer protocol, Electronic mail, Domain name system, DDNS, SSH, SNMP

Module 3: Transport layer

Transport layer services, Multiplexing and demultiplexing, User datagram protocol, Transmission control protocol: connection, features, segment, Round-Trip Time estimation and timeout, Flow control, Congestion control, SCTP

Module 4: Network layer

Router architecture, IPv4 addressing, IPv6 addressing, IPv4, Transition from IPv4 to IPv6, ICMP, Unicast routing protocols.

Module 5: Data link layer

Introduction, Error detection and correction, Multiple access links and protocols, Ethernet, ARP, DHCP, VLAN, MPLS

Module 6: Advanced Networking

Introduction to Software defined networking, Working of SDN, SDN in data centre, SDN applications, Data centre networking

Text books:

1. James F. Kurose and Keith W. Ross, "Computer Networking A Top-Down Approach", 6th edition, Pearson, 2013, ISBN: 978-0-13-285620-1
2. Paul Göransson, Chuck Black and Timothy Culver, "Software Defined Networks A Comprehensive Approach", 2nd edition, Elsevier, 2017, ISBN: 978-0-12-804555-8

Reference books:

1. Behrouz A. Forouzan, "Data Communications and Networking", 4th edition, McGrawHill Higher education, 2007, ISBN: 978-0-07-296775-3
2. William Stallings, "Data and Computer Communications", 8th edition, Pearson, 2006, ISBN: 0-13-243310-9
3. Thomas D. Nadeau and Ken Gray, "Software Defined Networks", Oreilly, ISBN: 978-1-449-34230-2

18CS2003	Computer Networks Lab	L 0	T 0	P 4	C 2

Course Objectives:

Enable the student to

1. design and troubleshoot networking topologies.
2. simulate various routing and switching protocols and wireless communication technologies.

Course Outcomes:

The student will be able to

1. list the various command line interface networking tools.
2. summarize the working of application layer protocols.
3. illustrate the operation of static and dynamic routing protocols.
4. experiment intra and inter VLAN routing concepts, ACL and NAT.
5. devise an addressing scheme for network design.
6. compare IPV4 and IPV6 functionalities.

List of Experiments:

1. Basic Networking Troubleshooting commands
2. Simulation of LAN Topology – HTTP, DNS & DHCP
3. IP Addressing and Subnetting
4. Static Routing configuration, testing and troubleshooting
5. Configuration, testing and troubleshooting of dynamic Routing protocols – RIP V1 & V2
6. Configuration, testing and troubleshooting of dynamic Routing protocols – OSPF & EIGRP
7. Configuration, testing and troubleshooting of dynamic Routing protocols VLAN
8. Access Control List
9. Static and Dynamic NAT
10. Simulation of LAN Using IPV6
11. Configuration, testing and troubleshooting of dynamic Routing protocol, RIPng
12. Configuration, testing and troubleshooting of frame relay
13. Configuration, testing and troubleshooting of wireless LAN
14. Configuration, testing and troubleshooting of PAP & CHAP

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS2004	Computer Organization and Architecture	L 3	T 0	P 0	C 3

Course Objectives:

Enable the student to

1. learn about the working of processor, main memory, and control unit.
2. understand various concepts of arithmetic unit and error correction

3. develop an awareness of the function and complexity of various processor architecture.

Course Outcomes:

The student will be able to

1. explain function of the central processing unit
2. develop algorithms for error correction for memory modules (main and cache memory)
3. design and understand various input and output modules for central processing unit
4. select and use standard addressing modes for logical and physical memory addressing
5. list and define various stages of instruction pipelining in processor.
6. explore various ways to implementing the micro instruction sequencing and execution

Module 1: Introduction to Computer Architecture

Introduction of computer organization and architecture, A top level view of computer function and interconnection

Module 2: Introduction to Internal Memory Technology

Introduction to interrupts, Multiple interrupts, Introduction to cache memory, Elements of cache design, Internal Memory, Semiconductor memory, Error correction, Advance DRAM

Module 3: Input / Output Modules and Scheduling

Introduction to external devices, Input / Output modules, Programed I/O, Interrupt driven I/O, Direct memory access, I/O channels and processors, introduction to process scheduling

Module 4: Computer Arithmetic and Instruction Set

Computer arithmetic, Integer representation and arithmetic, Floating point representation and arithmetic, types of operands and operations (Intel x86 and ARM processor), Addressing modes and formats

Module 5: Processor Structure and Functions

Instruction sets, Processor organization, Register organization, Characteristics and functions, Addressing modes, Processor structure and function, Instruction pipelining

Module 6: Control Unit and Micro Programmed Control

Control unit operation, Control of the processor, Hardwired implementation, Micro-program control, Micro instruction sequencing, Micro instruction execution.

Text Book:

1. William Stallings, "Computer Organization and Architecture: Designing for Performance", 8th edition, Pearson Education, 2010, ISBN:8131732452

Reference Books:

1. John P.Hayes, "Computer Organization and Architecture", McGraw Hill, 3rd edition, 2002, ISBN: 0070273553
2. John L.Hennessy, David A.Patterson, "Computer Architecture: A Quantitative Approach", Morgan Kaufmann, 5th edition, 2012, ISBN: 978-0-12-383872-8
3. Andrew S. Tanenbaum, Todd Austin, "Structured Computer Organization" Prentice Hall, 6th edition, 2013, ISBN-10: 0132916525.
4. Douglas E. Comer, "Essentials of Computer Architecture", Addision -Wesely, 1st edition, 2005, ISBN-10: 0131491792

18CS2005	Cryptography and Network Security	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. list the different kinds of security issues.
2. classify the various security algorithms and their features
3. combine the various security methods for designing a trusted secure network

Course Outcomes:

The student will be able to

1. summarize the computer security concepts and their needs.

2. apply the various symmetric and asymmetric key algorithms.
3. experiment with the various principles of cryptosystems, hashing algorithms and digital signatures
4. recognize the importance of network security.
5. evaluate network and internet security.
6. explain the different types of virus/worms & firewalls.

Module 1: Introduction to Cryptography and Symmetric Key Ciphers

Computer Security Concepts - OSI Security Architecture -Security Attacks - Services, Mechanisms - Symmetric Cipher Model - Traditional Block Cipher Structure - The Data Encryption Standard -The Strength of DES - Advanced Encryption Standard.

Module 2: Public Key Cryptography

Principles of public key cryptosystems-RSA algorithm-Diffie- Hellman Key Exchange-ElGamal Cryptosystem- Elliptic Curve Cryptography

Module 3: Cryptographic Data Integrity Algorithms

Applications of cryptographic hash functions-requirements and security-Secure Hash Algorithm -SHA3-Message authentication requirements, functions & codes-HMAC-digital signatures- NIST-Digital signature Algorithm (DSA)

Module 4: Key Management and User Authentication

X.509 certificates- Public Key infrastructure-remote user authentication principles-remote user authentication using symmetric and asymmetric encryption-Kerberos V5

Module 5: Web Security and Email Security

Web security issues-Secure Socket Layer-Transport Layer Security-pretty good privacy (PGP)-S/MIME

Module 6: IP and System Security

IP security overview-IP security policy-Encapsulating Security payload-intruders-intrusion detection-virus/worms-countermeasure-need for firewalls-firewall characteristics-types of firewalls

Text Books:

1. William Stallings, "Cryptography and network security: Principles and practices", 7th Edition, ISBN-13: 978-9332585225, Pearson Education.
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and network security", 3rd Edition, ISBN-13: 978-9339220945, McGraw Hill Education

Reference Books:

1. William Stallings, "Network Security Essentials: Applications and Standards", ISBN-13: 978-9352866601, 6th edition, Pearson Education.
2. Atul Kahate, "Cryptography and Network Security", 3rd Edition, McGraw Hill Education, ISBN-13: 978-1259029882
3. Wenbo Mao, "Modern Cryptography", First Edition, Pearson Education, 2008 ISBN-13: 978-0132887410
4. Roberta Bragg, Mark Rhodes, Keith Strassberg, "Network Security: The Complete Reference", Tata McGraw Hill Edition, 2008. ISBN-13: 978-0070586710
5. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: Private Communication in a Public World", Second Edition, Pearson Education, 2016, ISBN-13: 978-0130460196

18CS2006	Data Structure and Algorithms	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the concepts of linear data structures and algorithms.
2. identify the asymptotic performance and various strategies of algorithm design.
3. evaluate the performance and judge trade-offs of data structure implementations and algorithms.

Course Outcomes:

The student will be able to

1. identify the suitable linear data structure for the storage of data.
2. choose the appropriate algorithm design strategies for real time application development
3. develop applications using various linear data structures and by applying brute force and divide and conquer algorithm design strategies.
4. implement and analyze the algorithms and compare their performance in terms of space and time complexity
5. illustrate the working of sorting and searching algorithms and application of hashing.
6. apply the divide and conquer strategy for real time problems.

Module 1: Introduction

Data Abstraction - Abstract Data Type (ADT) - Algorithms - Fundamentals of Algorithmic Problem-solving - Analysis of Algorithms - Growth of Functions - Asymptotic Notations - Time-Space Trade-off

Module 2: Array based Linear Data Structures

Arrays - Stack ADT - Applications of Stack: Expression evaluation and conversion - Recursion - Queue ADT - Circular Queue - Applications of Queue

Module 3: Linked List based Linear Data Structures

Singly linked lists - Linked Stacks and Queues - Doubly linked lists - Circular linked lists - Applications

Module 4: Algorithm Analysis

Mathematical analysis of non-recursive algorithms - Mathematical analysis of recursive algorithms - Substitution Method - Recursion Tree Method - Master's Theorem - Amortized Analysis - Empirical Analysis - Algorithm Visualization

Module 5: Brute Force Algorithms, Sorting and Hashing

Sequential search and brute–force string matching - Bubble Sort - Selection Sort - Insertion Sort - Radix Sort - Performance comparison - Hashing

Module 6: Divide-and-Conquer Algorithms

Binary Search - Finding Min and Max - Merge Sort - Quick Sort - Multiplication of large integers and Strassen's Matrix Multiplication.

Text Books:

1. Mark Allen Weiss, "Data Structures and Problem Solving using Java", 4th Edition, Addison-Wesley, 2006.
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2011. ISBN13: 978-013231681
3. Robert Sedgewick and Kevin Wayne, "Algorithms", Fourth Edition, Addison Wesley.

Reference Books:

1. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design and Applications", Wiley.
2. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", Third Edition, Prentice Hall, 2010, ISBN: 9788120340077.
3. Ellis Horowitz, Sartaj Shani, Sanguthuvar Rajasekaran, "Fundamentals of computer Algorithms", Second Edition, 2008. ISBN- 978-81-7371-612-6

18CS2007	Data Structure and Algorithms Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. understand the basic principles of data structure and algorithms.
2. identify the performance of various kinds of data structures.
3. design and implement the data structure algorithms for real time applications.

Course Outcomes:

The student will be able to

1. infer the fundamental concepts of data structures.

2. prepare an efficient algorithm for real time problems using data structure.
3. demonstrate the working behaviors of various kinds of data structure.
4. analyze the performance of different data structures in terms of data management.
5. apply the algorithms for real time problems.
6. create an innovative applications with data structure and algorithms.

List of Experiments

1. Array Implementation of Stack and Queue ADTs
2. Application of Recursion
3. Linked list Implementation of List ADT.
4. Linked list Implementation of Stack ADT
5. Linked list Implementation of Queue ADT
6. Implementation of Doubly Linked List ADT
7. Implementation of Circular Linked List ADT
8. Applications of List, Stack and Queue ADTs.
9. Implementation of Sorting Algorithms
10. Implementation of Hash Table with any two collision resolution techniques
11. Implementation of Search Algorithms

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS2008	Database Management Systems	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the concepts of basic query language
2. apply the fundamentals of DDL, DML DCL and TCL
3. implement new developments and trends in developing a database

Course Outcomes:

The student will be able to

1. recognize the role of database administrator and database management systems in software applications and other advanced concepts.
2. use query language to retrieve data efficiently from the database.
3. design the database for given specification of the requirement design the databases using ER method and normalization.
4. design and implement significant database objects such as file structures and index schemes.
5. describe techniques for transaction processing and concurrency control.
6. implement security in database

Module 1: Database Architecture and Its Applications

System Application, Purpose of Database System, View of Data, Database Language, Relational Database, Database Design, Object-Based and Semi-structured Databases, Data Storage and Querying, Transaction Management, Data mining and Analysis, Database Architecture, Database Users and Administrators, Relational Model: Structure of Relational Databases, Fundamental Relational-Algebra operations, Additional Relational Algebra operations, Extended Relational Algebra, Null value, Modification of the database.

Module 2: Advanced Querying

Set Operations, Aggregate functions, Null values, Nested sub queries, Complex Queries, Views, Modification of Database. Advanced SQL: SQL Data Types and Schema, Integrity Constraint, Authorization, Embedded SQL, Dynamic SQL. Application Design and Development: Triggers

Module 3: ER Modeling and Normalization

E-R model, Constraints -E-R Diagram, E-R Design Issues, Weak Entity, Extended E-R Features, Database Design for Banking Enterprise, Reduction to Relational Schema Domain and data dependency, Armstrong's axioms, Normal forms, Dependency preservation, Lossless design.

Module 4: File Structure and Indexing

File organization, Organization of records in files, Data Dictionary Storage. Indexing and Hashing: Basic Concept, Ordered Indices, B+ Tree Index Files, B-Tree-Index Files, Multiple-Key Access, Static Hashing, Dynamic Hashing, Comparison of Ordered Indexing and Hashing. Transaction: Transaction concepts, Transaction State, Implementation of atomicity and durability, Concurrent executions, Serialization.

Module 5: Transaction Processing

Concurrency control, ACID property, Serializability of scheduling, Locking and timestamp based schedulers, Multi-version and optimistic Concurrency Control schemes, Database recovery.

Module 6: Database Security and Advanced Database Concepts

Security: Authentication, Authorization and access control – DAC, MAC and RBAC models, Intrusion detection, SQL injection. Object oriented and object relational databases, Logical databases, Web databases, Distributed databases, Data warehousing and data mining.

Text Books:

1. Abraham Silberschatz, Henry F. Korth, S. Sudarshan, "Database System Concepts", 6th Edition, McGraw-Hill. ISBN: 9332901384, 978-9332901384.
2. R. Elmasri and S. Navathe, "Fundamentals of Database Systems", 5th Edition, 2015, Pearson Education, ISBN: 0133970779, 978-0133970777.

Reference Books:

1. Garcia Molina, "Database Systems: The Complete Book", Third Impression, 2009, ISBN 978-81-317-0842- 2.
2. Raghu R. and Johannes G., "Database Management Systems", Third Edition, Tata McGraw Hill, 2014. ISBN 978-9339213114
3. J. D. Ullman, "Principles of Database and Knowledge – Base Systems", Vol 1 by Computer Science Press.
4. Serge Abiteboul, Richard Hull, Victor Vianu, "Foundations of Databases", Reprint by, Addison-Wesley
5. Thomas C. and Carolyn B., "Database Systems, A Practical Approach to Design, implementation and Management", Third Edition, Pearson Education, 2007. ISBN 81-7808-861

18CS2009	Database Management Systems Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. provide an introduction to Query Language
2. emphasize the fundamentals of DDL, DML DCL and TCL.
3. provide an understanding of new developments and trends in developing a database

Course Outcomes:

The student will be able to

1. create database objects
2. write efficient queries to retrieve information from the database
3. evaluate the normality of a logical data model and correct any anomalies.
4. develop Java application with database connectivity
5. familiarize in PL/SQL programming
6. develop web applications with database connectivity

List of Experiments

1. Implementation of DDL Commands
2. Demonstration of DML, TCL and DCL Commands

3. Aggregate and Built-in Functions
4. Set and Join operations
5. Sub query and Correlated sub query
6. Views, Sequences and Indexes
7. Procedures and Functions
8. Triggers
9. Java DB Connectivity
10. Web application development using PHP.

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS2010	Design and Analysis of Algorithms	L 3	T 0	P 0	C 3

Course Objectives:

Enable the student to

1. analyze the performance of algorithms.
2. understand the various algorithmic design techniques
3. define NP class of problems and their variations

Course Outcomes:

The student will be able to

1. analyze given algorithm and express its complexity in asymptotic notation
2. design algorithms using greedy and dynamic programming techniques
3. propose solutions using backtracking and branch-and-bound technique
4. apply suitable algorithmic technique to solve a problem
5. solve problems using fundamental graph algorithms
6. identify the problems belonging to the class of P, NP-Complete or NP-Hard

Module 1: Introduction and Performance Analysis

Introduction: Performance analysis, Asymptotic Notations & Basic Efficiency Classes. Asymptotic analysis of complexity bounds – best, average and worst-case behaviour, Time and space trade-offs, Analysis of recursive algorithms through recurrence relations: Substitution method, Recursion tree method and Masters' theorem.

Module 2: Brute Force and Greedy Methods

Brute-Force: Searching and String Matching, Greedy: General Method, Huffman Codes Knapsack Problem, Task Scheduling Problem, Optimal Merge Pattern.

Module 3: Dynamic Programming

Matrix Chain Multiplication, Longest Common Sequences – Warshall's Transitive Closure and Floyds All Pairs Shortest Path Algorithm – 0/1 Knapsack – Optimal Binary Search Tree – Travelling Salesman Problem.

Module 4: Branch-and-Bound and Backtracking Methodologies

Branch-and-Bound: Knapsack, Travelling Salesman Problem, Backtracking: Knapsack, Sum of subsets, 8-Queens Problem, Bin-packing

Module 5: Graph Algorithms

Traversal algorithms: Depth First Search (DFS) and Breadth First Search (BFS); Prim's and Kruskal's Minimum Spanning Tree, Topological sorting, Network Flow Algorithm.

Module 6: Class P and NP

Tractable and Intractable Problems: Computability of Algorithms, Computability classes – P, NP, NP, Complete and NP-hard. Cook's theorem, Approximation algorithms.

Text Books:

1. Thomas H Cormen, Charles E Lieserson, Ronald L Rivest, Clifford Stein, "Introduction to Algorithms", 4TH Edition, 2009, MIT Press/McGraw-Hill, ISBN: 0262033844, 978-0262033848.

2. Ellis Horowitz, Sartaj Sahni, Sanguthevar Rajasekaran, "Fundamentals of Computer Algorithms", 2nd Edition, 2008, ISBN: 9788173716126, 8173716129.

Reference Books:

1. Eva Tardos, Jon Kleinberg, "Algorithm Design", 1st Edition, 2014, Pearson Edition, ISBN: 9789332518643, 9332518645.
2. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design: Foundations, Analysis, and Internet Examples", John Wiley & Sons, Inc, 2nd Edition, 2009, ISBN: 0470088540, 9780470088548
3. UdiManber, "Algorithms -- A Creative Approach", 3rd Edition, Addison-Wesley, ISBN: 0201120372, 9780201120370

18CS2011	Design and Analysis of Algorithms Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. develop coding for problems using various algorithmic design techniques
2. implement solution for the same problem using different algorithm techniques.
3. apply graph theory to solve path finding problems.

Course Outcomes:

The student will be able to

1. design the code using greedy technique
2. develop solutions for real time problems using dynamic programming techniques
3. propose solutions using backtracking technique
4. apply branch and bound technique to solve a problem
5. solve problems using fundamental graph algorithms
6. develop code for real life problems like shortest path and MST using graph theory.

List of Experiments:

1. Implement greedy solution to solve fractional knapsack problem.
2. Implement greedy algorithm for scheduling tasks with deadlines.
3. Implement dynamic programming solution for 0/1 knapsack problem.
4. Implement dynamic programming to compute the longest common subsequence of two strings.
5. Implement dynamic programming solution to find optimal path for travelling salesman problem.
6. Implement dynamic programming technique to find optimal ordering of matrix multiplication.
7. Implement backtracking algorithm to solve the problem of placing eight non-attacking queens on an (8x8) chessboard.
8. Implement branch and bound method of solving 0/1 knapsack problem.
9. Implement Dijkstra's algorithm to find the shortest path from single source to other vertices.
10. Implement the Prim's algorithm algorithms for finding Minimum Spanning Tree in a graph.
11. Implement the Kruskal's algorithm algorithms for finding Minimum Spanning Tree in a graph.
12. Implement Floyd's algorithm to find all pairs' shortest path.

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS2012	Fabrication, Testing and Troubleshooting Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. give hands-on learning with PCB design simulation tool.
2. understand steps involved in PCB fabrication process.
3. develop skills in basic electronic component testing, assembly and soldering practices.

Course Outcomes:

The student will be able to:

1. construct the circuit schematic for single layer PCB using simulation tool.

2. develop the relevant routing procedures in the PCB board layout.
3. prepare the pre requisite materials and solutions for the PCB fabrication process.
4. examine the bare board PCB for open and shorts.
5. assemble the electronic components in the prepared PCB board.
6. conduct prototype board testing with necessary measuring equipment's.

List of Experiments

1. Study of PCB Simulation Tool
2. Study of Schematics of PCB Simulation Tool
3. Design of PN Junction Diode as a switch using simulation tool
4. Design of Zener Diode as voltage Regulator using simulation tool
5. Design and study of ON/OFF characteristics of LED
6. Design and study of Transistor as a switch using simulation tool
7. Fabrication of PCB Circuit (Diode/ZENER/LED/BJT)
8. Assembling and Testing of PCB

18CS2013	Machine Learning Techniques	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the human learning aspects and primitives in learning process by computer
2. analyze the nature of problems solved with machine learning techniques
3. design and implement suitable machine learning technique for a given application

Course Outcomes

The student will be able to

1. describe the concepts, mathematical background, applicability, limitations of existing machine learning techniques.
2. identify the performance evaluation criteria of the model developed
3. analyze and design various machine learning based applications with a modern outlook focusing on recent advances.
4. build the learning model for a given task
5. apply some state-of-the-art development frameworks and software libraries for implementation
6. evaluate the performance of machine learning algorithms using suitable metrics

Module 1: Introduction

Definition - Types of Machine Learning - Examples of Machine Learning Problems - Training versus Testing - Characteristics of Machine learning tasks - Predictive and descriptive tasks - Machine learning Models: Geometric Models, Logical Models, Probabilistic Models. Features: Feature types - Feature Construction and Transformation - Feature Selection.

Module 2: Classification and Concept Learning

Classification: Binary Classification- Assessing Classification performance - Class probability Estimation - Multiclass Classification - Regression: Assessing performance of Regression - Error measures - Overfitting- Theory of Generalization: Effective number of hypothesis - Bounding the Growth function.

Module 3: Linear and Probabilistic Models

Least Squares method - Multivariate Linear Regression - Perceptron, Multiple Layer Perceptron - Support Vector Machines - Obtaining probabilities from Linear classifiers - Kernel methods for non-Linearity - Probabilistic models for categorical data – Naïve Bayes Classifier

Module 4: Distance Based Models

Distance Based Models: Neighbors and Examples - Nearest Neighbors Classification - Distance based clustering – K-Means Algorithm - K-Medoids Algorithm - Hierarchical clustering - Vector Quantization, Self-Organizing Feature Map - Principal Component Analysis.

Module 5: Rule Based and Tree Based Models
Rule Based Models: Rule learning for subgroup discovery - Association rule mining - Tree Based Models: Decision Trees - Ranking and Probability estimation Trees - Regression trees - Classification and Regression Trees (CART)
Module 6: Trends in Machine Learning
Ensemble Learning, - Bagging and Boosting - Random Forest - Meta learning - Deep Learning - Reinforcement Learning – Applications.

Text Books:

1. P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012, ISBN-10: 1107422221, ISBN-13: 978-1107422223.
2. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Second Edition (Springer Series in Statistics), 2016, ISBN-10: 0387848576, ISBN-13: 978-0387848570

Reference Books:

1. Christopher Bishop, "Pattern Recognition and Machine Learning (Information Science and Statistics)", Springer, 2007.
2. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012, ISBN-10: 0262018020, ISBN-13: 978-0262018029
3. Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, "Learning from Data", AMLBook Publishers, 2012 ISBN 13: 978-1600490064.
4. Tom Mitchell, "Machine Learning", McGraw-Hill, 1997, ISBN-10: 0071154671, ISBN-13: 978-0071154673.

18CS2014	Object Oriented Programming	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. understand the basic concepts of C++ and Java
2. develop high quality, internally documented, well-structured object oriented program.
3. adapt object oriented principles such as abstraction and information hiding in software development.

Course Outcomes:
The student will be able to
1. define the object-oriented programming concepts.
2. select the relevant object oriented concepts to implement a real time application with design patterns.
3. demonstrate the application of polymorphism in various ways.
4. illustrate the use of inheritance, exceptions, generics and collection.
5. develop applications with event-driven graphical user interface and file management .
6. describe software development process.

Module 1: Programming Basic, Decision Making and Functions Using C++
Basic program construction, Data types, Arrays, Operators, Control statements, Simple functions, Passing arguments to functions, Returning values from functions, Reference arguments, Recursion, Inline functions, Scope and storage class.
Module 2: **Introduction to Java Programming, Classes and Objects**
Features of Java, JDK, JRE and JVM, Structure of java program, Class fundamentals, Declaring objects, Constructors, Garbage collection, Overloading methods, Nested and inner classes.
Module 3: Inheritance, Packages and Interfaces
Member access and inheritance, Using super, Method overriding, Dynamic method dispatch, Defining a package, Access protection, Importing packages, Defining an interface and implementing interfaces.

Module 4: Exception Handling, Multithreading and Wrapper Classes
Exception-handling fundamentals, Exception types, Uncaught exceptions, Using try and catch, throw, throws, finally, Built-in exceptions, Creating user-defined exceptions, Java thread model, Creating threads, Boxing and unboxing.
Module 5: Input Output Handling, File Handling, Collection and Generics
Input output basics, Reading console input, Writing console output, Reading and writing files, ArrayList, Generic class, Bounded types, Creating a generic method.
Module 6: Design Patterns, Graphical Programming and Software Development Process
Introduction to design patterns, Iterator pattern and model-view-controller pattern, Simple swing application, Event handling, Painting in swing, Swing user interface elements, Software development process.

Text Books:

1. Herbert Schildt, "Java: The Complete Reference", 10th edition, McGraw Hill Education, 2017, ISBN-10: 1259589331.
2. Robert Lafore, "Object Oriented Programming in C++", 4th edition, Tech Media, 2008. ISBN 0-672-32308-7.

Reference Books:

1. Herbert Schildt, "C++: The Complete Reference", 5th edition, Tata McGraw-Hill, 2015. ISBN 978-0071634809.
2. Paul J. Deitel, Harvey M. Deitel, "C++: How to Program", Pearson, 2014, ISBN 780273793298.
3. Harvey M. Dietel, "Java How to Program", 7th edition, Prentice Hall, 2007. ISBN:978-0132222204.
4. Elisabeth Freeman, "Head First Design Patterns", O′Reilly, 1st edition, 2004, ISBN-10: 0596007124.
5. Kathy Sierra, Bert Bates, "Head First Java", 2nd edition, O'Reilly Media, 2005. ISBN: 10-0596004656, ISBN-13:9780596004651.

18CS2015	Object Oriented Programming Lab	L	T	P	C
		0	0	4	2

Course Objectives:
Enable the student to
1. understand the basic of C++ and Java.
2. develop programs using object oriented features such as composition of objects, inheritance, polymorphism etc.
3. build software development skills using C++/Java programming for real world applications.

Course Outcomes:
The student will be able to
1. describe the structure and model of the C++/Java programming language.
2. use the Java programming language for various programming technologies.
3. develop software in the Java programming language.
4. evaluate user requirements for software functionality required to decide whether the java programming language can meet user requirements.
5. propose the use of certain technologies by implementing them in the Java programming language to solve the given problem.
6. choose an engineering approach for solving problems, starting from the acquired knowledge of programming.

List of Experiments
1. Control Statements
2. Array
3. Class and Objects
4. Inheritance

5. Packages
6. Interface
7. Exception Handling
8. String Handling
9. File Handling
10. GUI using Swing

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS2016	Operating Systems	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the architecture of operating system including kernel.
2. compare and contrast the common algorithms used for both pre-emptive and non-pre-emptive scheduling of tasks in operating systems.
3. critique the issues in designing an operating system.

Course Outcomes:

The student will be able to

1. define and describe the operating system and its structures.
2. distinguish between process and threads.
3. choose different process scheduling algorithms.
4. illustrate critical section problem and synchronization.
5. explain deadlock detection and avoidance.
6. develop techniques for optimal allocation of resources to processes.

Module 1: Operating System Introduction

Generation of Operating systems, Operating System Structure, Operating System Operations and services- System Calls, System Programs, Operating System Design and Implementation, Operating System Structure, Virtual Machines -- System Boot. Case study on Linux and Windows OS.

Module 2: Process Management

Process Concept, Process Scheduling, Operation on Processes, Inter-process Communication-Multithreaded Programming -Multithreading models, Thread Libraries, Threading Issues, Process Scheduling, Basic concepts, Scheduling Criteria, Scheduling Algorithms: Preemptive and Non pre-emptive algorithms, Multiple Processor Scheduling – Thread Scheduling.

Module 3: Process Synchronization

Inter process Communication- The Critical Section Problem, Peterson's Solution, Synchronization Hardware, Semaphores, Classic Problems of Synchronization, Monitors, Atomic Transactions.

Module 4: Deadlocks and Memory Management

Deadlock Characterization, Methods for Handling Deadlocks -Deadlock Prevention, Deadlock avoidance, Deadlock detection, Recovery from Deadlock.

Memory management Strategies, Swapping, Contiguous memory Allocation, Paging, Structure of the Page Table – Segmentation.

Module 5: Virtual Memory Management and File Management

Demand Paging: Copy on Write, Page Replacement, Allocation of Frames, Thrashing, Memory-mapped Files, Allocating Kernel Memory. Storage Management-File Concepts, Access Methods, Directory Structure -File System Mounting, File Sharing, Protection, Implementing File Systems -File System Structure, File System Implementation, Directory Implementation, Allocation Methods, Free Space Management, Efficiency and Performance, Recovery**.**

Module 6: Secondary Storage Management and I/O Systems

Secondary Storage Management -Structure, Overview of Mass Storage Structure, Disk Structure, Disk Attachment, Disk Scheduling, RAID Structure. I/O Systems, I/O Hardware, Application I/O interface, Kernel I/O Subsystem, Transforming I/O Requests to Hardware Operations**.**

Text Books:

1. Peter Galvin, Greg Gagne Silberschatz, "Operating System Concepts Essentials", 9th Edition, Wiley Asia Student Edition, ISBN: 9781118804926, 1118804929
2. William Stallings, "Operating Systems: Internals and Design Principles", 5th Edition, Prentice Hall of India, ISBN: 9789332518803, 9332518807

Reference Books:

1. Andrew S. Tanenbaum, "Modern Operating Systems", Fourth Edition, Prentice Hall, 2015. ISBN-10: 013359162X
2. D. M. Dhamdhere, "Operating Systems", Second Edition, Tata McGraw-Hill Education (India), 2009. ISBN 978-0-07-295769-3.
3. Achyut S. Godbole "Operating Systems With Case Studies in Unix Netware Windows NT", Tata McGraw-Hill, 2005. ISBN: 007059113X, 9780070591134.
4. Pramod Chandra P. Bhatt, "An Introduction to Operating Systems: Concepts and Practice", PHI Learning Pvt. Ltd., 2003. ISBN: 8120323068, 9788120323063.
5. Paul J. Deitel, David R. Choffnes, "Operating Systems", Third Edition, Prentice Hall, 2007ISBN: 9788131712894, 8131712893
6. Colin Ritchie "Operating Systems Incorporating UNIX and Windows: Incorporating UNIX and Windows", Fourth Edition, Cengage Learning EMEA, 2003. ISBN: 0826464165, 9780826464163.

18CS2017	Operating Systems Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. understand the commands of Unix.
2. implement various algorithms required for management, scheduling, allocation and communication used in operating system.
3. demonstrate OS mechanisms programmatically with real time problems.

Course Outcomes:

The student will be able to

1. experiment with Unix commands and shell programming
2. build a program for process and file system management using system calls.
3. choose the best CPU scheduling algorithm for a given problem instance.
4. identify the performance of various page replacement algorithms .
5. demonstrate the various kinds of page replacement algorithms with real time examples.
6. develop algorithm for deadlock avoidance, detection and file allocation strategies

List of Experiments

1. Basic UNIX commands and file access permission in Unix.
2. Shell programming
3. UNIX system calls for file access.
4. Simulation of CPU Scheduling Algorithms
   a) FCFS b) Optimal c)Round robin d) Priority
5. Simulate producer-consumer problem using semaphores.
6. Simulate Bankers algorithm for the deadlock avoidance.
7. Simulate Multiple Programming with fixed Number of Tasks
8. Implement the all page replacement algorithms a) FIFO b) LRU c) MFU
9. Implement File Allocation Strategies

a) Sequential Allocation b) Indexed Allocation c) Linked Allocation
10. Implement all File Organization Techniques
    a) Single level directory b) Two level directory
11. Simulate disk scheduling algorithms a) FCFS b) SCAN c) C-SCAN
12. Implement Paging Technique of memory management.

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS2018	Software Engineering	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. identify and apply appropriate software life cycle model to design the high level system.
2. design the structure and behaviour of the software system using UML diagrams.
3. apply software testing and quality assurance techniques at the module level to ensure good quality software.

Course Outcomes:

The student will be able to

1. discover an effective software engineering process to develop software-intensive systems.
2. translate the requirements specification into an implementable design.
3. construct UML diagrams along with design strategies and design patterns.
4. analyze architectural design methods.
5. evaluate the system using various testing strategies.
6. develop the software system with quality measures.

Module 1: Process Models

Prescriptive Process models: Waterfall model, Incremental process models, Evolutionary process models, Concurrent models, Unified Process, Agile process models, Agile Teams.

Module 2: Understanding Requirements

Requirement engineering, Eliciting requirements, Building the analysis model, Negotiating requirements, Requirements monitoring, Validating requirements, UML diagrams.

Module 3: Software Design

Design process – concepts – Abstraction – Architecture – Patterns, Separation of concerns – Modularity, Information hiding, Functional Independence – Refinement – Aspects – Refactoring, Object oriented design concepts, Design classes, Dependency inversion, Design for test, Architectural styles, Designing class based components – cohesion and coupling, Domain engineering, User interface analysis and design.

Module 4: Fundamentals of Testing

Object oriented testing strategies: Verification and Validation, Unit Test, Integration Test, Testing web applications – Content testing, User interface testing, Component level testing , Navigation testing, Configuration testing, Security testing, Performance testing, white box testing, black box testing. Review techniques Informal and Formal Technical review.

Module 5: Software Quality Assurance

Statistical Software Quality Assurance – Six sigma and ISO 9000, Software Configuration Management – SCM Repository and SCM Process. Software measurement, Metrics for software quality.

Module 6: Software Project Management

Project planning process, Software project estimation, Empirical estimation models – COCOMO II model, Project scheduling, Timeline charts, Tracking the schedule. Risk management – Risk mitigation, Monitoring and Measurement. Software Process Improvement – CMMI.

Text Books:

1. Roger Pressman S., Bruce R. Maxim, "Software Engineering: A Practitioner's Approach", Eighth Edition, McGraw- Hill, 2015, ISBN 978-0-07-802212-8.
2. Ian Sommerville, "Software Engineering", Ninth Edition, Pearson Education Ltd, 2016. ISBN 10: 1-292-09613-6.

Reference Books:

1. Rod Stephens, "Beginning Software Engineering", John Wiley & Sons, Inc., 2015, ISBN: 978-1-118-96914-4.
2. Rajib Mall, "Fundamentals of Software Engineering", Fourth Edition, PHI Learning Pvt Ltd, 2014, ISBN: 978-81-203-4898-1.
3. Bernd Bruegge and Allen Dutoit, "Object-Oriented Software Engineering: Practical software development using UML, Patterns and Java", third Edition, Pearson Education, 2013, ISBN: 1292037091, 9781292037097.
4. Robert K. Wyzocki, "Effective Project Management", Seventh Edition, WILEY-Dreamtech India Pvt. Ltd, 2013. ISBN: 978-1-118-72916-8.
5. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, "Fundamentals of Software Engineering", Second Edition, PHI,2015, ISBN: 9789332555396, 9332555397.

18CS2019	System Software and Compiler Design	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. learn about the working of assembler, loaders, and macro-processors.
2. define and describe various concepts of language translation and compiler design
3. develop an awareness of the function and complexity of modern compilers.

Course Outcomes:

The student will be able to

1. explain algorithm and data structures for assembler
2. develop algorithms for macros and loaders
3. list and define various stages of compiler.
4. select and use standard tools and techniques in different stages of compiler design
5. compare and contrast various methods for implementing the phases of a compiler
6. design and construct different phases of the compiler

Module 1: Introduction to System Software

Assemblers: Basic assembler functions: A simple SIC assembler, Loaders and Linkers: Basic Loader functions: Design of an Absolute Loader, A Simple Bootstrap Loader, Linkage Editors. Macro processors: Basic Macro Processor functions: Macro Definition and Expansion

Module 2: Introduction to Compiler and Lexical Analysis

The Structure of a compiler- Lexical Analysis, Regular Language, Finite Automata, Regular Expression, Regular Expression to Finite Automata- Lexical-Analyzer Generator (LEX).

Module 3: Syntax Analysis and Parser

Context-Free Grammar, Top-Down Parsing, LL(1) Grammar, Bottom-Up Parsing, LR Parsers, Parser Generator (YACC).

Module 4: Semantic Analysis and Runtime Environment

Syntax Directed Definition, Evaluation Orders for SDD's, Syntax Directed Translation Schemes, Storage Organization, Stack Allocation of Space.

Module 5: Intermediate Code Generation

Different Types of Intermediate Forms, Types and Declarations, Translation of Expressions -Type Checking, Control Flow.

Module 6: Code Generation and Code Optimization

Issue in the Design of a Code Generator, Optimization of Basic Blocks, Peephole Optimization, Principal Sources of Optimization, Data-Flow Analysis.

Text Books:

1. L. Beck, System Software, "An Introduction to System Programming", Addison Wesley, Third Edition 2007. ISBN: 978-81-7758-555-1
2. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, "Compilers: Principles, Techniques and Tools", Second Edition, Pearson Education, 2015, ISBN:9789332518667

Reference Books:

1. D. M. Dhamdhere, "Systems Programming and Operating Systems", Tata McGraw-Hill Company, 2009. ISBN: 9780074635797.
2. John J. Donovan, "Systems Programming", Tata McGraw Hill-Edition, 2009. ISBN: 9780074604823.
3. K.D. Cooper, and L. Torczon, "Engineering a Compiler", Elsevier, 2012, ISBN: 978-0-12-088478-0
4. Dick Grone, Kees van Reeuwijk, Henri E Bal, Ceriel J H Jacobs, and Koen G Langendoen, "Modern Compiler Design", John Wiley and Sons, Second Edition, 2012. ISBN: 978-1-4614-4699-6
5. Allen I. Hollub, "Compiler Design in C", PHI Learning, 2009. ISBN: 978-8120307780
6. David Galles, "Modern Compiler Design", Pearson Education 2009, ISBN-10:8131709418

18CS2020	System Software and Compiler Lab	L	T	P	C
		0	0	4	2

Co-requisite:18CS2018 System Software and Compiler Design

Course Objectives:

Enable the student to

1. develop skills to design various phases of compiler construction.
2. design the simulation of loader, assembler, and macro processor.
3. gain knowledge in the internal details of various modern compilers.

Course Outcomes:

The student will be able to

1. recognize various methods for representing the pattern of tokens.
2. identify the pros and cons of using various compiler design techniques.
3. choose the suitable compiler construction tools like Lex and Yacc.
4. examine and analyze the working of various system software.
5. design and construct different phases of compiler.
6. select the appropriate compiler or interpreter for real time application development.

List of Experiments

1. Write a program to perform token separation for a subset of any given programming language.
2. Write a program for maintaining symbol table.
3. Write a program to simulate Macro-processor.
4. Write a LEX program to perform token separation.
5. Write a program to simulate DFA.
6. Write a YACC program to perform the basic operations of a calculator.
7. Write a program to simulate assembler.
8. Write a program to simulate loader.
9. Write a program to simulate a predictive parser.
10. Write a program to generate intermediate code.
11. Write a YACC program to check language acceptance for a given grammar.
12. Write a program to minimize DFA.

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS2021	Theory of Computation	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. construct finite automata to accept a set of strings of a language.
2. identify the hierarchy of formal languages, grammars and machines and understand the concepts of computability and decidability.
3. design context free grammars to generate strings from a context free language and convert them into normal forms.

Course Outcomes:

The student will be able to

1. recall the concept of languages and the hierarchy of languages.
2. develop finite automata to accept a set of strings of a language.
3. classify the given language based on chomsky's hierarchy.
4. construct context free grammars to generate strings of context free language.
5. determine equivalence of languages accepted by Push Down Automata and languages generated by context free grammars
6. compare computability & non-computability and Decidability & Un-decidability.

Module 1: Introduction

Alphabet – strings, languages and grammars, productions and derivation, Chomsky hierarchy of languages.

Module 2: Regular Languages and Finite Automata

Regular expressions and languages, deterministic finite automata (DFA) & equivalence with regular expressions, nondeterministic finite automata (NFA) & equivalence with DFA, regular grammars & equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, minimization of finite automata.

Module 3: Context-Free Languages and Pushdown

Context-free grammars (CFG) and languages (CFL), Chomsky and Greibach normal forms, nondeterministic pushdown automata (PDA) and equivalence with CFG, parse trees, ambiguity in CFG, pumping lemma for context-free languages, deterministic pushdown automata, closure properties of CFLs.

Module 4: Context-Sensitive Languages

Context-sensitive grammars (CSG) and languages, linear bounded automata and equivalence with CSG.

Module 5: Turing Machines

The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages and their closure properties, variants of Turing machines, nondeterministic TMs and equivalence with deterministic TMs, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

Module 6: Undecidability

Church-Turing thesis, Universal Turing machine, the universal and diagonalization languages, reduction between languages and Rice's theorem, undecidable problems about languages.

Text Books:

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, "Introduction to Automata Theory, Languages, and Computation", 3rd edition, Pearson Education Asia. 2014, ISBN: 978-93-325-3586-2.
2. Peter Linz, "An Introduction to Formal Languages and Automata", 6th Edition, Jone and Bartlett Student Edition, 2016. ISBN 9789384323219.

Reference Books:

1. Harry R. Lewis and Christos H. Papadimitriou, "Elements of the Theory of Computation", Pearson Education Asia. 2nd edition 2015. ISBN 9789332549890.

2. Dexter C. Kozen, "Automata and Computability," Undergraduate Texts in Computer Science, Springer.2012, ISBN 9781461273097.
3. John Martin, "Introduction to Languages and The Theory of Computation", Tata McGraw Hill. 3rd edition 2009, ISBN 9780070660489.
4. Kamala Krithivasan, Rama R, "Introduction to Formal Languages, Automata Theory and Computation", Pearson Edition, 2009. ISBN: 9788131723562.

18CS2022	Web Technology	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. provide knowledge in the design and development of interactive web applications integrated with database.
2. utilize open source web application framework and its associated plugins to enable responsive web application development.
3. provide latest skills and project-based experience in emerging technologies needed for entry into web development careers.

Course Outcomes:

The student will be able to

1. identify the relevant properties and methods which facilitate dynamic application development.
2. explain the development of fully functional web applications that incorporates planning, designing, coding, testing, and publishing to a web server.
3. apply latest client and server side technologies for creating interactive data driven websites.
4. model dynamic web applications using suitable latest server-side technologies integrated with database.
5. formulate and build extensible web applications using the Model View Controller design pattern.
6. select appropriate design standards for designing attractive web pages.

Module 1: Web Essentials and Data Representation

The Internet- Hyper Text Transport Protocol, HTTP Request and Response – Web Clients – Web Servers, HTML, XML, DTD – JSON.

Module 2: Web Styling

Introduction to CSS, Backgrounds and color gradients, Fonts and Text Styles, List Styles and Table Layouts – CSS selectors, Box model, Positioning and Layouts, Effects and Controls in CSS.

Module 3: Client Side Programming

Overview of JavaScript, JavaScript Functions and Events, Browser Objects, Document Object Model – Validation and Security.

Module 4: Server Side Programming

Introduction to PHP – Decision and Control statements, Functions and Objects, Form handling in PHP

Module 5: Data Management with PHP

Cookies – Sessions tracking and Authentication, Accessing MySQL using PHP- AJAX

Module 6: Web Development Frameworks

Introduction to AngularJS – Directives, Controllers and Modules, Creating Our First Controller, Working with and Displaying Arrays, Working with ng-repeat, Working with ng-model, Working with Forms, Form Validation and States, Nested Forms with ng-form, Working with Filters, Routing Using ngRoute, Routing in a Single-Page Application , Introduction to Bootstrap.

Text Books:

1. DT Editorial Services, "HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, Ajax, PHP and jQuery", Dreamtech Press, 2nd Edition, 2015, ISBN-13: 9789350040959.
2. Robin Nixon, "Learning PHP, MySQL and JavaScript" O'Reilly Media, Inc., 3rd Edition 2014, ISBN: 978-1- 4919-4946-7| ISBN-10:1-4919-4946-5.

Reference Books:

1. Zak Ruvalcaba, Murach's "HTML5 and CSS3", Mike Murach & Associates, 3rd Edition, 2015, ISBN: 1890774839 | 9781890774837.
2. David Sklar, Adam Trachtenberg, "PHP Cookbook: Solutions and Examples for PHP Programmers", O'Reilly Media, 3rd Edition, 2014, ISBN: 978-1-4493-6375-8 | ISBN 10:1-4493-6375-X
3. Stephen Radford, "Learning Web Development with Bootstrap and AngularJS", Packt Publishing Ltd., May 2015, ISBN 978-1-78328-755-0.
4. Brad Green, Shyam Seshadri, "AngularJS: Up and Running", O'Reilly Media, Inc., September 2014, ISBN: 9781491901946.
5. Jeffrey C Jackson, "Web technologies: A Computer Science Perspective", Pearson Education,Inc., 1st edition 2008,ISBN-10: 8131717151

18CS2023	Web Technology Lab	L 0	T 0	P 4	C 2

Co-requisite: 18CS2022 Web Technology

Course objectives:

Enable the student to

1. design dynamic websites with good aesthetic sense using HTML5 and CSS3.
2. analyze problems as well as identify the technologies appropriate to their solutions.
3. develop hands on experience using latest technologies integrated with database such as PHP and AJAX.

Course Outcomes:

The student will be able to

1. select latest standards like HTML5 for designing attractive static web pages and separate design from content using CSS3.
2. identify a technology currently available in the market to design responsive websites.
3. apply the client-side scripting techniques required to develop dynamic websites.
4. compare the latest server-side technologies for synchronous and asynchronous data transfer between client and server.
5. design and develop web applications integrated with database using server-side scripting techniques like PHP, AJAX and MySQL.
6. choose data formats like XML and JSON for the delivery of electronic information.

List of Experiments:

1. Basic Website using HTML5 [Form + Media Elements]
2. Responsive webpage using HTML5 and CSS3
3. XML document for any web application and validate with DTD
4. JavaScript – DOM Elements and Events
5. JavaScript – Timer Functions and Objects
6. Session Management with PHP Cookies and session
7. PHP – MySQL Database Connection
8. Simple Web page with dynamic content from server (XML/JSON/MySQL) through AJAX.
9. Online Dashboard with Bootstrap
10. Single Page website with AngularJS

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS2921	COMPREHENSIVE PRACTICES	L	T	P	C
		0	0	3	1.5

Course Objective:

Enable the student to

1. integrate the knowledge gained in various core domains in computer science and engineering to develop a holistic understanding.
2. enhance analytical skills to comprehend the practical issues.
3. develop their logical thinking to solve real time problems

Course Outcome:

The student will be able to

1. recall the fundamental concepts
2. improvise his/ her analytical skills
3. analyze the requirements of the real time challenges to solve them.
4. enhance his/ her logical skills
5. develop logics to solve the challenges/ problems
6. formulate solutions using the skills acquired

List of subjects for this course shall be

1. Programming in C++ & Java
2. Object Oriented Programming concepts using C++ & Java
3. Operating Systems & Unix Architecture
4. Computer Architecture
5. Computer Networks
6. System Software & Compiler Design
7. Data Structures and Algorithms
8. Database Systems
9. Web Technology
10. Overview of current, cutting edge technologies

The faculty shall conduct revision in these core computer science and engineering subjects; also, the faculty shall conduct online examinations during every session.

Note: The students shall write internal examinations similar to any other theory papers.

18CS3001	Advanced Algorithms	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. provide an introduction to advanced algorithms and its complexities
2. analyses the efficiency of various algorithms using advanced algorithmic techniques
3. design efficient algorithms using various design techniques

Course Outcomes:

The student will be able to

1. state the correctness of the basic algorithms for the classic problems.
2. understand the mathematical foundation in analysis of algorithms
3. analyze the efficiency of algorithms using time and space complexity
4. understand different algorithmic design strategies
5. choose the appropriate data structure for solving a particular set of problems.
6. developing efficient algorithms of various problems in different domains

Module 1: Sorting and Graph: Review of various sorting algorithms - Topological sort - Graph Shortest path by BFS - Dijkstra's algorithm - DFS - computation of strongly connected components- Amortized analysis.

Module 2: Greedy Paradigm and Graph Matching: Introduction to greedy paradigm, algorithm to compute a maximum weight maximal independent set - Application to MST - Graph matching - Characterization of maximum matching by augmenting paths -Edmond's Blossom algorithm to compute augmenting path.

Module 3: Divide and Conquer Paradigm and Flow-Networks: Introduction to divide and conquer paradigm - Stassen's algorithm - inverse of a triangular matrix – LUP decomposition - Maxflow-mincut theorem – Ford Fulkerson Method to compute maximum flow – Edmond Karp maximum flow algorithm.

Module 4: Dynamic Programming Paradigm and Modulo Representation of Integers or Polynomials: Introduction to dynamic programming paradigm - Floyd-Warshall algorithm - Chinese Remainder Theorem - Conversion between base-representation and modulo-representation - Extension to polynomials.

Module 5: Linear Programming and Discrete Fourier Transform (DFT): Formulating problems as linear programs - The simplex algorithm - DFT in modulo ring - Fast Fourier Transform algorithm - Schonhage Strassen Integer Multiplication algorithm.

Module 6: NP-Completeness: NP-hardness and NP-completeness -Approximation algorithms - Randomized Algorithms - Interior Point Method-Advanced Number Theoretic Algorithm.

Reference Books:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, "Introduction to Algorithms", Third edition PHI Learning, 2010. ISBN: 10: 8120340078. ISBN: 8120321413.
2. A.V. Aho, J. E. Hopcroft and J. D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education Asia, 2003. ISBN-10: 0201000296.
3. Jeffrey Mcconnell, "Analysis of Algorithm", Jones and Battlet, 2008. ISBN-10: 0-7637- 0782-1.
4. Sara Baase and Allen Van Gelder, "Computer Algorithms - Introduction to Design and Analysis", Pearson Education Asia, 2003. *ISBN*-10: 0201612445
5. Michael T. Goodrich, Roberto Tamasia, "Algorithm Design", First Edition, John Wiley and sons, 2001. ISBN: 0471383651

18CS3002	Advanced Computer Networks	L	T	P	C
		3	0	0	3

Course Objective:

Enable the student to

1. understand the possibilities of interconnecting multiple physical networks into a coordinated system.
2. learn the details of the global TCP/IP internet including the architecture of its router system and the application protocols it supports.
3. learn the working principles of Multiprotocol Label Switching.

Course Outcome:

The student will be able to

1. identify and discuss the concepts underlying protocols, and their main characteristics and functionality
2. identify the various TCP/IP protocols that used for particular networking application
3. recognize the requirement of Interior and exterior routing protocols that are used for different networks.
4. understand the behavior of internetworking different networks in MPLS networks.
5. apply knowledge of the TCP/IP layering model to intelligently debug networking problems
6. understand theoretical and practical concepts behind the design of multi-constrained applications and services

Module 1: Foundation and Physical Network Design

Building a Network, Applications, Requirements, Network Architecture, Implementing Network Software, Performance, Connecting to a Network: Perspectives on Connecting, Encoding (NRZ, NRZI, Manchester, 4B/5B), Framing, Error Detection, Reliable Transmission, Ethernet and Multiple Access Networks (802.3), Wireless

Module 2: Internetworking

Switching and Bridging, Basic Internetworking (IP), IPv6: notation, header format, fragmentation, extension header, DHCP, Routing, Implementation and Performance, Scaling to Billions, The Global Internet, Multicast, Multiprotocol Label Switching (MPLS), Routing among Mobile Devices,

Module 3: Logical Network Design

Getting Process to Communicate, Simple Demultiplexer (UDP), Reliable Byte Stream (TCP), Remote Procedure Call, Transport for Real-Time Applications (RTP), Congestion Control and Resource Allocation: Issues in Resource Allocation, Queuing Disciplines, TCP Congestion Control, Congestion-Avoidance Mechanisms, Quality of Service

Module 4: Applications

Traditional Applications: Electronic Mail (SMTP, MIME, IMAP), World Wide Web (HTTP), Web Services, Multimedia Applications: Session Control and Call Control(SDP, SIP, H.323), Resource Allocation for Multimedia Applications, Infrastructure Services: Name Service (DNS), Network Management (SNMP), Overlay Networks: Routing Overlays, Peer-to-Peer Networks, Content Distribution Networks

Module 5: Next Generation Networking

Software Defined Networks, Evolution of switches and control planes, Centralized and distributed data and control planes, OpenFlow and SDN Controllers, Network Function Virtualization, Content Centric Networking and Named Data Networking

Module 6: Network Programming

UNIX Socket address structures, Byte ordering and byte manipulation functions, TCP client and server, Elementary UDP sockets, Raw sockets

Reference Books:

1. Larry L. Peterson and Bruce S. Davie, "Computer Networks a Systems Approach", Fifth Edition, Elsevier, 2012, ISBN: 978-0-12-385059-1
2. Paul Göransson, Chuck Black, "Software Defined Networks A Comprehensive Approach", Elsevier, 2014, ISBN: 978-0-12-416675-2
3. W. Richard Stevens, Bill Fenner, Andrew M. Rudoff, "UNIX® Network Programming Volume 1, Third Edition: The Sockets Networking API", Addison Wesley, 2003, ISBN: 0-13-141155-1
4. Ying-Dar Lin, Ren-Hung Hwang, and Fred Baker, "Computer Networks: An Open Source Approach", McGraw-Hill, 2012, ISBN 978-0-07-337624-0
5. W. Richard Stevens, TCP/IP Illustrated Volume – I, The Protocols, Second Edition, Addison-Wesley, 2011. ISBN: 978-0321336316.
6. Uyless Black, MPLS and Label Switching Networks, Pearson Education, Second Edition, 2002. ISBN: 81-7808-650-6.
7. Silvia Hagan, IPv6 Essentials, 2nd edition, O Reilly, ISBN: 978-0-596-10056-2.
8. Behrouz A. Forouzan, TCP/IP Protocol Suite, Tata McGraw Hill, Fourth Edition, 2009. ISBN: 978-0073376042
9. Douglas E. Comer, Internetworking with TCP/IP – Principles, Protocols and Architecture, Pearson Education, Fifth Edition, 2007. ISBN: 978-81-203-2998-0.
10. Radia Perlman, Interconnections-Bridges, Routers, Switches and Internetworking Protocols, second edition, Addison-Wesley Professional, 2000, ISBN:978-0201634488
11. Andrew S. Tenenbaum, David J. Wetherall, Computer Networks, Prentice Hall, Fifth Edition, 2011, ISBN: 978-0-13-212695-3

18CS3003	Advanced Computer Networks Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. design and troubleshoot networking topologies.
2. simulate the various routing and switching protocols and wireless communication technologies.
3. experiment the SDN technologies

Course Outcomes:

The student will be able to

1. list the various command line interface networking tools.
2. summarize the working of various protocols.
3. illustrate the operation of static and dynamic routing protocols.
4. experiment intra and inter VLAN routing concepts, ACL and NAT.
5. configure and troubleshoot STP and VTP protocols
6. compare SDN and traditional network functionalities.

List of Experiments

1. Investigate the different options and parameters one can set for a TCP connection. (Do "man tcp" on Unix.) Experiment with various parameter settings to see how they affect TCP performance.
2. Use anonymous FTP to connect to ftp.rfc-editor.org (directory in-notes), and retrieve the RFC index. Also, retrieve the protocol specifications for TCP, IP, and UDP.
3. Analysis of Unix traceroute command.
4. Access Control Lists (ACL) Part1
    a. Configuring Standard ACLs
    b. Configuring an ACL on VTY Lines
    c. Configuring Named Standard ACLs
5. Access Control Lists (ACL) Part 2
    a. Configuring Extended ACLs 1
    b. Configuring Extended ACLs 2
    c. Configuring Named Extended ACLs
    d. Troubleshooting ACLs
6. Network Address Translation for IPv4 (NAT)
    a. Investigating NAT Operation
    b. Implementing Static and Dynamic NAT
    c. Configuring NAT Pool Overload and PAT
7. Virtual Local Area Networks (VLANs)
    a. Basic VLAN Configuration
    b. Troubleshooting a VLAN Implementation
8. Inter-VLAN Routing
    a. Configuring traditional inter-VLAN routing
    b. Configuring router-on-a-stick inter-VLAN routing
    c. Troubleshooting Inter-VLAN Routing
9. Practical lab on real network equipment
    a. Configuring Per-Interface Inter-VLAN Routing
    b. Configuring 802.1Q Trunk-Based Inter-VLAN Routing
10. VLAN Trunk Protocol (VTP)
    a. Basic VTP configuration
11. Spanning-Tree Protocol (STP)
    a. Configuring STP
12. Introduction to Wireless LANs
13. Dynamic Host Configuration Protocol (DHCP)
    a. Configuring DHCP
14. Software Defined Network (SDN) experiment using Mininet and POX Controller

a. Create a network and run a simple performance test
b. Create a simple network and use a POX controller to contrl the behaviors of switch
c. Use “ovs-vsctl” command to directly control open vswitch
d. Advanced “ovs-vsctl” usage examples
e. Dynamically change the network parameters—change link delay
f. A simple controller
g. Measure the Path Loss Rate
h. Measure the Latency
i. Limit the bandwidth
j. Test features request/reply
k. Dynamically change the forwarding rules

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS3004	Advanced Cryptography and Network Security	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. classify the different kinds of security issues.
2. apply the various principles of cryptosystems, hashing algorithms and digital signatures.
3. understand various methods for designing firewalls and trusted systems.

Course Outcomes:

The student will be able to

1. recognize the importance of cryptography.
2. distinguish different kinds of attacks and design new security features.
3. apply key management using various symmetric and asymmetric key algorithms.
4. categorize cryptographic data integrity algorithms
5. explain the different types of firewalls
6. evaluate wireless network and cloud security

Module 1: Introduction to Cryptography and Symmetric Key Ciphers

Computer Security Concepts - OSI Security Architecture - Security Attacks – Security Services - Security Mechanisms – Symmetric Cipher Model - Substitution Techniques – Transpositions Techniques - Steganography - Traditional Block Cipher Structure - The Data Encryption Standard - The Strength of DES – Block Cipher Design Principles - Advanced Encryption Standard

Module 2: Stream Cipher and Public Key Cryptography

Stream Ciphers – RC4 - Principles of Public Key Cryptosystems – The RSA Algorithm - Diffie- Hellman Key Exchange - Elgamal Cryptographic System- Elliptic Curve Cryptography

Module 3: Cryptographic Data Integrity Algorithms

Applications of Cryptographic Hash Functions - Requirements and Security - Secure Hash Algorithm - SHA3 - Message Authentication Requirements, Message Authentication Functions – Requirements of Message Authentication Codes – HMAC - Digital Signatures- NIST Digital Signature Algorithm (DSA)

Module 4: Key Management and User Authentication

X.509 Certificates - Public Key Infrastructure - Remote User Authentication Principles - Remote User Authentication using Symmetric and Asymmetric Encryption - Kerberos V5

Module 5: Cloud, Web Security and Email Security

Cloud Computing – Cloud Security Risks and Counter Measures – Data Protection in Cloud - Cloud Security as a Service – Addressing Cloud Computing Security Concerns - Web Security Considerations - Transport Layer Security - Pretty Good Privacy (PGP) - S/MIME

Module 6: IP and System Security

IP Security Overview - IP Security Policy - Encapsulating Security Payload – Intruders -Intrusion Detection – The Need for Firewalls - Firewall Characteristics and Access Policy - Types of Firewalls – Wireless Security – Mobile Device Security – IEEE 802.11i Wireless LAN Security

Reference Books:

1. William Stallings, "Cryptography and network security: Principles and practices", 7th Edition, Pearson Education, 2017. ISBN-13: 978-9332585225.
2. Behrouz A. Forouzan, Debdeep Mukhopadhyay, "Cryptography and Network Security", 3rd Edition, McGraw Hill Education, 2015. ISBN-13: 978-9339220945.
3. William Stallings, "Network Security Essentials: Applications and Standards", 6th edition, Pearson Education, 2018. ISBN-13: 978-9352866601.
4. Atul Kahate, "Cryptography and Network Security", 3rd Edition, McGraw Hill Education, 2017, ISBN-13: 978-1259029882.
5. Wenbo Mao, "Modern Cryptography", First Edition, Pearson Education, 2008, ISBN-13: 978-0132887410
6. Roberta Bragg, Mark Rhodes, Keith Strassberg, "Network Security: The Complete Reference", Tata McGraw Hill Edition, 2008. ISBN-13: 978-0070586710.
7. Charlie Kaufman, Radia Perlman, Mike Speciner, "Network Security: Private Communication in a Public World",2nd Edition, 2016, Pearson Education, reprint, ISBN:978-0130460196.

18CS3005	Advanced Data Structures	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the non-linear data structures such as trees and graphs.
2. demonstrate the various algorithmic design techniques
3. formulate algorithmic techniques for solving any given problem.

Course Outcomes:

The student will be able to

1. select an appropriate design technique for finding solution to a problem.
2. design algorithms using greedy and dynamic programming techniques
3. propose solutions using backtracking and branch and bound technique
4. analyze the efficiency of various algorithms and express its complexity in asymptotic notation
5. solve problems using fundamental graph algorithms
6. identify the problems belonging to the class of P, NP, NP-complete or NP-hard

Module 1: Trees

Binary Tree - Representation - Traversals of Binary Tree and Implementation - Binary Search Trees - Priority Queues - Binary Heap and Applications

Module 2: Search Trees

AVL Trees - Splay Trees - B-trees - B+ Trees - 2-3-4 Trees - Red Black Trees - Tries - Applications

Module 3: Graphs

Mathematical background- Graph Representation and Traversals - Depth First Search, Breadth First Search - Topological Sort - Shortest path algorithms - Minimum spanning trees - Applications

Module 4: Greedy Algorithms

Huffman Codes - Optimal Merge Patterns - Job Sequencing with Deadlines - Knapsack Problem.

Module 5: Dynamic Programming

All pairs shortest path - Travelling Salesman Problem - 0/1 Knapsack Problem - Matrix Chain Multiplication - Longest Common Subsequence - Optimal Binary Search Tree.

Module 6: Backtracking and Computability

N Queens problem - Sum of Subsets - Bin-packing - Tractable and Intractable problems - Computability of algorithms - Computability classes - P, NP, NP-complete, NP-hard - Approximation Algorithms

Reference Books:

1. Ellis Horowitz, Sartaj Sahni, Sanguthuvar Rajasekaran, "Fundamentals of computer Algorithms", Second Edition, 2008. ISBN- 978-81-7371-612-6

2. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Clifford Stein, "Introduction to Algorithms", Third Edition, Prentice Hall, 2010. ISBN: 9788120340077, 8120340078
3. Michael T. Goodrich, Roberto Tamassia, "Algorithm Design and Applications", John Wiley & Sons, 2014. ISBN-13: 978-1118335918
4. Robert Sedgewick and Kevin Wayne, "Algorithms", Fourth Edition, Addison Wesley. (2011). ISBN-13: 978-0321573513
5. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2011. ISBN13: 978-013231681

18CS3006	Advanced Data Structures and Algorithms Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. develop coding for problems using various algorithmic design techniques
2. implement solution for the same problem using different algorithm techniques.
3. apply graph theory to solve path finding problems.

Course Outcomes:

The student will be able to

1. design the code using greedy technique
2. develop solutions for real time problems using dynamic programming techniques
3. propose solutions using backtracking technique
4. apply branch and bound technique to solve a problem
5. solve problems using fundamental graph algorithms
6. develop code for real life problems like shortest path and MST using graph theory.

List of Experiments

1. Implement greedy solution to solve fractional knapsack problem.
2. Implement greedy algorithm for scheduling tasks with deadlines.
3. Implement dynamic programming solution for 0/1 knapsack problem.
4. Implement dynamic programming to compute the longest common subsequence of two strings.
5. Implement dynamic programming solution to find optimal path for travelling salesman problem.
6. Implement dynamic programming technique to find optimal ordering of matrix multiplication.
7. Implement backtracking algorithm to solve the problem of placing eight non-attacking queens on an (8x8) chessboard.
8. Implement branch and bound method of solving 0/1 knapsack problem.
9. Implement Dijkstra's algorithm to find the shortest path from single source to other vertices.
10. Implement the Prim's algorithm algorithms for finding Minimum Spanning Tree in a graph.
11. Implement the Kruskal's algorithm algorithms for finding Minimum Spanning Tree in a graph.
12. Implement Floyd's algorithm to find all pairs' shortest path.

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS3007	Advanced Database Management Systems	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. gain extensive knowledge on database system architecture, system implementation techniques query processing and optimization.
2. acquire in depth knowledge on transaction processing concepts, concurrency control techniques, database recovery techniques, database security and authorization.
3. understand the concepts of application-oriented and system-oriented approach towards database design.

Course Outcomes:

The student will be able to

1. identify alternative designs for implementation of database systems, including data models, file structures, index schemes, and query evaluation.
2. recognize appropriate techniques for transaction processing, concurrency control, backup and recovery that maintain data integrity in database systems.
3. apply locks and isolation levels to the concurrent transactions.
4. analyze the operation of parallel and distributed database.
5. design and implement significant database objects such as file structures and index schemes.
6. explain the concepts of information retrieval and spatial data management.

Module 1: Overview Of Query Evaluation

The System catalog- introduction to Operator Evaluation- Algorithms for Relational Operators-Introduction to Query Optimization-Alternative Plans: example- A Typical Relational Query Optimizer: Translating SQL Queries into Algebra- Estimating the cost of a plan- Relational Algebra Equivalences-Enumeration of Alternative plans- Nested Subqueries- The System R Optimizer

Module 2: Overview of Transaction Management

The ACID Properties-Transactions and Schedules-Concurrent Execution of Transaction-Lock-Based Concurrency Control-Performance of Locking-Transaction Support in SQL-Introduction to Crash Recovery - Concurrency Control - 2PL, Serializability and Recoverability-Introduction to Lock Management-Lock Conversion-Dealing with Deadlock-Specialized Locking Techniques- Concurrency Control without Locking. Crash Recovery: Introduction To ARIES -The Log: Other Recovery-Related Structures-The Write-ahead Log Protocol -Check Pointing- Recovering from a System Crash -Media Recovery.

Module 3: Physical Database Design and Tuning

Introduction to Physical Database Design - Guidelines for Index Selection-Clustering and Indexing - Tools to Assist Index Selection - Overview of Database Tuning -Choices in Tuning the Conceptual Schema-Choices in Tuning Queries and Views -Impact of Concurrency- Case Study: The Internet Shop.

Module 4: Parallel and Distributed Databases

Architecture for Parallel Databases-Parallel Query Evaluation- Parallelizing Individual Operations-Parallel Query Optimization-Types of Distributed Databases -Distributed DBMS Architecture-Storing Data in Distributed DBMS- Distributed Catalog management-Distributed Query Processing-Updating Distributed Data Distributed Transaction-Distributed Concurrency Control-Distributed Recovery.

Module 5: Spatial Data Management: Types of Spatial Data and Queries-Application involving Spatial Data-Introduction to Spatial Indexes-Indexing Based on Space Filling Curves Grid files -R-Trees -Issues in High Dimensional Indexing.

Module 6: Security and Authorization:

Introduction to Database Security-Access Control- Discretionary and Mandatory Access Control-Security for Internet Application - Additional Issues Related to Security.

Reference Books:

1. Raghu R. and Johannes G., "Database Management Systems", Third Edition, Tata McGraw Hill, 2014. ISBN 978-9339213114
2. Elmasri and Navathae, "Fundamentals of Database Systems", Sixth Edition, Pearson Education /Addison Wesley, 2010. ISBN 0136086209
3. Abraham S., Henry F.Korth and Sudarshan, "Database System Concepts", Fifth Edition, McGraw-Hill Publication, 2006. ISBN: 007-124476-X
4. Thomas C. and Carolyn B., "Database Systems - A Practical Approach to Design, implementation, and Management", Third Edition, Pearson Education, 2007. ISBN 81-7808-861
5. Li Yan, Zongmin Ma, "Advanced Database Query Systems: Techniques, Applications and Technologies", Idea Group Inc (IGI), 2011, ISBN : 160960475X

18CS3008	Advanced Database Management Systems Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

- familiarize with PL/SQL for storing, maintaining and querying large databases effectively.
- acquire knowledge on advanced techniques in handling concurrent transactions.
- practice with NoSQL databases

Course Outcomes:

The student will be able to

1. describe and use various advanced query concepts such as subquery, correlated subquery, procedures, functions
2. select the appropriate locking techniques and apply it on the database objects.
3. analyze the concurrent transactions and deadlocks.
4. practice backup and recovery.
5. Work with NoSQL databases
6. design and implement database application.

List of Experiments

1. Database Design and Management
    a. Create the table using DDL
    b. Maning the table using DML
    c. Transaction Control using TCL
    d. Aggregate functions
    e. Built in function
2. Advanced Queries
    a. Set Operations
    b. Sub query
    c. Corelated subquery
3. Database Locks
    a. Isolation Levels
    b. Lock/Unlock
4. Views & Materialized Views
    a. Create
    b. Modify
    c. Drop
5. Administrating User Privileges
    a. Creating User
    b. Authorization using DCL
    c. Locking/unlocking user
    d. Deleting User
6. PL/SQL
    a. Triggers
    b. Cursors
    c. Procedures and Functions
    d.
7. MongoDB
    a. DB creation
    b. Collections
    c. Aggregate Functions
    d. Import and Export
8. Cassandra
    a. Keyspace Creation
    b. Table Creation

c. Querying

9. Neo4j
    a. Creating the nodes
    b. Creating the relationships
    c. Querying the graph
10. GIS Database Programming
11. Data Cleaning
    Download data from the standard dataset and perform data cleaning
12. Application Development using Database Connectivity

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS3009	Advanced Machine Learning	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the key concepts of machine learning.
2. appreciate supervised, unsupervised and reinforcement learning, probabilistic, graphical models and their applications.
3. choose the right model for various real time applications

Course Outcomes:

The student will be able to

1. summarize the theoretical and practical aspects of advanced machine learning techniques
2. compare the strengths and limitations of selected machine learning techniques and where they can be applied for different applications.
3. identify the relevant tool for different machine learning techniques.
4. analyze the problem thoroughly and identify the advanced machine learning approaches and paradigms.
5. design and implement suitable machine learning technique to a given task
6. evaluate and compare the performance of the selected approaches for a given problem

Module 1: Introduction

Machine Learning Foundations - Key concepts - Applications - Types of machine learning - Supervised/Unsupervised Learning, Loss functions and generalization, Probability Theory, Parametric vs Non-parametric methods, Elements of Computational Learning Theory, Ensemble Learning, Bagging, Boosting, Random Forest.

Module 2: Supervised Learning

Linear Models for Classification - Discriminate Functions -Probabilistic Generative Models - Probabilistic Discriminative Models – The Laplace Approximation - Bayesian Logistic Regression - Decision Trees - Classification Trees- Regression Trees - Pruning. Neural Networks - Feed-forward Network Functions - Error Back propagation Regularization - Mixture Density and Bayesian Neural Networks.

Module 3: Unsupervised Learning

Clustering - K-means - EM - Mixtures of Gaussians - The EM Algorithm in General - Model selection for latent variable models - High-Dimensional spaces - Dirichlet Process Mixture Models – Affinity Propagation – Spectral Clustering – Hierarchical Clustering – Bi-clustering.

Module 4: Kernel Methods

Kernel Methods for non-linear data - Dual Representations - Radial Basis Function Networks – Gaussian Processes – Sparse Kernel Machines: Maximum Margin Classifiers – Relevance Vector Machines - Support Vector Machines, Kernel Ridge Regression, Structure Kernels, Kernel PCA, Latent Semantic Analysis.

Module 5: Graphical Model and Structural Learning:
Introduction – Bayesian Networks, Linear Gaussian Models, Conditional Independence, Structure Learning for Knowledge Discovery – Learning Tree Structures - Learning DAG Structures - Learning DAG Structures with Latent Variables - Learning Casual DAGs – Learning Undirected Gaussian Graphical Models – Learning Undirected Discrete Graphical Models.

Module 6: Advanced Topics
Energetic Learning – Hopfield Network, The Boltzmann Machine, Introduction to Deep Learning – Deep Belief Network, Applications.

Reference Books:

1. Kevin Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012, ISBN-10: 0262018020, ISBN-13: 978-0262018029
2. Christopher Bishop, Pattern Recognition and Machine Learning (Information Science and Statistics), Springer, 2007.
3. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/Crc Machine Learning and Pattern Recognition Series, 2014, SBN-10: 1466583282, ISBN-13: 978-1466583283
4. Ethem Alpaydin, Introduction to Machine Learning (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014, ISBN-10: 0262028182, ISBN-13: 978-0262028189.
5. Tom Mitchell, Machine Learning, McGraw-Hill, 1997, ISBN-10: 0071154671, ISBN-13: 978-0071154673.
6. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning: Data Mining, Inference, and Prediction, Second Edition (Springer Series in Statistics), 2016, ISBN-10: 0387848576, ISBN-13: 978-0387848570
7. Stephen Marsland, Machine Learning – An Algorithmic Perspective, Second Edition, Chapman and Hall/Crc Machine Learning and Pattern Recognition Series, 2014, SBN-10: 1466583282, ISBN-13: 978-1466583283.

18CS3010	Advanced Web Technology	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. create dynamic websites with good aesthetic sense of designing.
2. develop and implement solutions to problems encountered in all phases of the design process.
3. apply a variety of technologies to create, capture and manipulate design elements in producing a final product.

Course Outcomes:
The student will be able to
1. identify the business logic within the database.
2. editing, publishing and modifying the content of the website.
3. establish communication among various applications through web services.
4. organize and manage resources using web frameworks.
5. test and debug object oriented PHP scripts.
6. create and deploy a portable web based system.

Module 1: Server Side Programming
PHP – using arrays, string manipulation and regular expressions, functions, object oriented PHP, error handling.

Module 2: Web Database
MYSQL – Designing database, creating database, working with database, accessing database from web server with PHP, advanced MYSQL administration and programming.

Module 3: Web Development Framework

Laravel - web and PHP frameworks, Routing and controllers – route definitions, route groups, views, controllers, route model binding, route caching, form method spoofing, CSRF Protection, redirects, aborting the request, custom responses, testing.

Module 4: Laravel – Blade Template

Echoing data – control structures - template inheritance – view composers and service injection – custom blade directives – testing. Laravel – front end Components – requests and responses.

Module 5: Joomla Framework

Streamline the authoring process, customizing Joomla with widgets, constructing a dynamic template, Template overrides, JavaScript and AJAX to dynamically load page elements.

Module 6: Web Services

Joomla web services, security administration and configuration, testing the site with Selenium, using development Tools, creating Joomla menus, Articles, and Categories with PHP, creating core extensions, connecting Joomla and Facebook, development and deployment.

Reference Books:

1. Laravel up & running, "A framework for building modern PHP APPS", O' Reilly, Matt Stauffer, Fifth edition, 2016, ISBN: 9781491936085.
2. Luke Welling, Laura Thomson, "PHP and MYSQL Web Development", Fifth edition, 2016, ISBN-13:978-0-321-83389-1.
3. Robin Nixon, "Learning PHP, MySQL & JavaScript: With jQuery, CSS & HTML5" O'Reilly, Fifth edition, 2018, ISBN-13: 978-1491978917, ISBN-10: 1491978910.
4. Sinha, Sanjib, "A beginner's guide to application development with Laravel 5.3", Apress, 2017, ISBN: 978-1-4842-2537-0.
5. Raphael Saunier, "Getting started with Laravel 4", Packet publishing Ltd, 2014, ISBN: 978-1-78328-703-1.
6. Dan Rahmel, "Advanced Joomla!", Apress, 2013, ISBN: 978-1-4302-1628-5.
7. Stephen Burge, "Joomla 3 Explained", OSTraining, 2017, ISBN-10:1521459975, ISBN-13:978-1521459973.

18CS3011	Advanced Web Technology Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. apply a structured approach to identifying needs, interests, and functionality of a website.
2. use fundamental skills to maintain web server services required to host a website.
3. develop the most important technologies that are being used today by web developers to build a wide variety of web applications.

Course Outcomes:

The student will be able to

1. discover the website to effectively communicate using diverse visual elements.
2. observe and plan an internet based business to apply appropriate business models and web technologies.
3. use scripting languages and web services to transfer data and add interactive components to web pages.
4. articulate the website using appropriate security principles, focusing specifically on the vulnerabilities inherent in common web implementations.
5. recommend the best practices in navigation, usability and written content to design websites that give users easy access to the information they seek.
6. combine multiple web technologies to create advanced web components.

List of Experiments

1. PHP program to find the first non-repeated character in a given string.

2. PHP function to generate a random password contains uppercase, lowercase, numeric and other using shuffle() function.
3. Design a HTML form and associated PHP script to allow the administrator to add items to the database. The script should check for product code duplication before adding an entry. If the code is a duplicate then it should report an error about the conflicting data already exists.
4. PHP script to print a price list for browsing. The price list should be a table that displays product code, description and sale price. The sale price is computed from the cost price using the percentage markup stored in the table.
5. Implement CSRF to handle the security tokens while multiple tabs are open and the user is working in both of them.
6. Integrate PayPal facility with a website using PHP to enable e-payments.
7. Develop a shopping cart using Laravel framework.
8. Migrate the blogs of one website to other website using Laravel migration database dictionary.
9. Make a slideshow run on dynamically loaded webpage using AJAX.
10. Create a website to manage banners for advertising using Joomla.
11. Design a Joomla forum to share ideas and views on particular issues.
12. Run the automated test for Joomla CMS.

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS3012	Advanced Wireless and Mobile Networks	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. discover the wireless/mobile market and the future needs and challenges.
2. describe the key concepts of wireless networks, standards, technologies and their basic operations.
3. evaluate the MAC and different network protocols using network simulation software tools.

Course Outcomes:

The student will be able to

1. understand advanced knowledge of networking and wireless networking
2. describe various types of wireless networks, standards, operations and use cases.
3. compare WLAN, WPAN, WWAN, Cellular based upon underlying propagation and performance analysis.
4. demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
5. summarize wireless networks exploring trade-offs between wire line and wireless links.
6. develop mobile applications to solve some of the real world problems.

Module 1: Introduction and WLAN

Wireless Networking Trends, Key Wireless Physical Layer Concepts, Multiple Access Technologies - CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling, Challenges in Mobile Computing: Resource poorness, Bandwidth, energy etc. Wireless Local Area Networks**:** IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues.

Module 2: Wireless Cellular Networks

1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread Spectrum Technologies.

Module 3: WiMAX and Wireless Sensor Networks
WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Overview. Wireless Sensor Networks: Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.
Module 4: Wireless PAN
Bluetooth and Zigbee, IEEE 802.15, IEEE 802.16, Introduction to Wireless Sensors.
Module 5: Security
Security in Wireless Networks Vulnerabilities, Security techniques, Wi-Fi Security, DoS in Wireless Communication.
Module 6: Advanced Topics
IEEE 802.11x and IEEE 802.11i Standards, Introduction to Vehicular Adhoc Networks, Drone Networks.

Reference Books:

1. Jochen Schiller, "Mobile Communications", Pearson Publisher, 2nd Edition, 2009, ISBN: 9788131724262, 8131724263.
2. William Stallings, "Wireless Communications and Networks", Pearson Education, 2009, ISBN: 9788131720936, 8131720934
3. Stojmenic Ivan, "Handbook of Wireless Networks and Mobile Computing", John Wiley and Sons Inc, 1st Edition, 2010, ISBN-788126507689, 8126507683.
4. Yi Bing Lin and Imrich Chlamtac, "Wireless and Mobile Network Architectures", John Wiley and Sons Inc, 2008, ISBN-8126515600, 9788126515608.
5. Pandya Raj, "Mobile and Personal Communications Systems and Services", PHI, 2004, ISBN: 9780780347083, 0780347080.

18CS3013	Big Data Analytics	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. learn the basic concepts of big data, its characteristics and applications
2. understand NoSQL big data management.
3. design applications with map-reduce using Hadoop and related tools

Course Outcomes:
The student will be able to
1. describe the big data concepts, sources, phases and characteristics
2. classify various NoSQL databases
3. illustrate the different eco system components of Hadoop
4. develop application using MongoDB, Cassandra and Hbase
5. justify the need of using Hadoop framework for big data analytics
6. use the Pig and Hive for application development

Module 1: Introduction to Big Data and NoSQL
Types of Digital Data - Introduction to Big Data - Big Data Analytics. NoSQL - Types of NoSQL - Need for NoSQL - Advantages - Limitations - Vendors - SQL vs NoSQL - NewSQL - Aggregate Data Models - More Details on Data Models - Distribution Models - Consistency.
Module 2: Document and Graph Databases
Document Database - Features - Suitable Use Cases - When not to Use - MongoDB - Need for MongoDB - Terms used in RDBMS and MongoDB - Data Types in MongoDB - MongoDB Query Language - Graph Database - Features - Suitable Use Cases - When not to Use.
Module 3: Column- Family Databases
Column-Family Stores - Features - Suitable Use Cases - When not to Use - Introduction to Cassandra - Features - CQL Data Types - CQLSH - Keyspaces - CRUD - Collections - Alter Commands - Import and Export - Hbase - Introduction - The Basics - Architecture.

Module 4: Introduction to Hadoop

Introduction to Hadoop - Features - Key Advantages - Distributors - Need for Hadoop - RDBMS vs Hadoop - Distributed Computing Challenges - History of Hadoop - Overview - Use Cases - HDFS - Processing Data with Hadoop - Managing Resources and Applications with YARN - Interacting with Hadoop Eco System.

Module 5: MapReduce Programming

MapReduce Programming - Introduction - Mapper - Reducer - Combiner - Partition - Searching - Sorting - Compression- How MapReduce Works - MapReduce Types and Formats - MapReduce Features.

Module 6: Pig and Hive

Introduction to Hive – architecture – data types – primitive data types – collection data types – file format – Hive Query Language (HQL) – Pig: Key features of Pig – Anatomy – Pig on Hadoop – Pig philosophy – Pig Latin – Data types – Execution modes – Pig Vs Hive

Reference Books:

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley India, 2015. ISBN: 978 -81-265-5478-2.
2. Lars George, "HBase: The Definitive Guide", O'Reilly Media, 2011. ISBN: 978-93-5023-503-4
3. Michael Minelli, Michelle Chambers, and Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley, 2013.
4. Tom White,"Hadoop:The Definitive Guide" , O'Reilly Media, Second Edition Revised & Updated, 2011. ISBN: 978-93-5023-127-2
5. Pramod J. Sadalage and Martin fowler, "NoSQL: A Brief Guide to the Emerging World", 2013. ISBN: 978-81-317-7569-1.
6. Kristina Chodorow, "MongoDB: The Definitive Guide", O'Reilly Media, Second Edition, 2013. *ISBN*: 978-1-4493-4468-9
7. Chuck Lam, "Hadoop in Action", Manning Publications Co, 2011. ISBN: 978-81-7722-813-7.
8. Eric Sammer, "Hadoop Operations", O'Reilley, 2012. ISBN: 1449327052, 9781449327057

18CS3014	Biometrics	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student

1. describe the principles of the three core biometric modalities, and know how to deploy them in authentication scenarios.
2. identify the privacy and security concerns surrounding biometric systems, and know how to address them in such a way that balances both.
3. deploy statistical methods in biometric system evaluation.

Course Outcomes:

The student will be able to

1. understand the basic principles of bio-metric methods and systems.
2. recognize the various modules constituting a bio-metric system.
3. use different types of bio-metric traits and to appreciate their relative significance.
4. apply the feature sets used to represent some of the popular bio-metric traits.
5. evaluate and design security systems incorporating bio-metrics.
6. infer the challenges and limitations associated with bio-metrics.

Module 1: Introduction to Bio-metrics Systems

Introduction and Definitions of bio-metrics, Traditional authenticated methods and technologies.

Module 2: Bio-metric Technologies

Bio-metric technologies: Fingerprint, Face, Iris, Hand Geometry, Gait Recognition, Ear, Voice, Palm print, On-Line Signature Verification, 3D Face Recognition, Dental Identification and DNA.

Module 3: The Law of Bio-metric Systems

The Law and the use of multi bio-metrics systems, Biometrics and the US Constitution, Privacy Issues in the Application of Biometrics: a European Perspective.

Module 4: Statistical Measurement of Bio-metric

Statistical measurement of Bio-metric, Bio-metrics in Government Sector and Commercial Sector.

Module 5: Case Studies of Bio-metric System

Case Studies of bio-metric system, Bio-metric Transaction. Bio-metric System Vulnerabilities.

Module 6: Recent Trends in Bio-metric Systems

Recent trends in Bio-metric technologies and applications in various domains. Case study of 3D face recognition and DNA matching.

Reference Books:

1. Paul Reid, "Biometrics for network security", Prentice Hall PTR, 2003, ISBN-10: 0131015494, 978-0131015494
2. J. Wayman, A.K. Jain, D. Maltoni, and D. Maio (Eds.), "Biometric Systems: Technology, Design and Performance Evaluation", ISBN-10: 1852335963, 978-1852335960, Springer, 2005.
3. D. Maltoni, D. Maio, A. K. Jain, and S. Prabhakar, "Handbook of Fingerprint Recognition", Springer Verlag, 2003.
4. 2. A. K. Jain, R. Bolle, S. Pankanti (Eds.), "BIOMETRICS: Personal Identification in Networked Society", Kluwer Academic Publishers, 1999.
5. 3. Anil Jain, Arun A. Ross, Karthik Nanda kumar, "Introduction to Biometric", Springer, 2011.

18CS3015	Cloud Computing	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the concepts of virtualization and its application in cloud
2. recognize the needs of Cloud and gain working experience in cloud
3. apply the security models in cloud environment and automate the configuration management

Course Outcomes:

Students will be able to

1. infer the concept of virtualization in the cloud computing
2. use the concepts of cloud storage, cloud networks and its management
3. identify the architecture, infrastructure and delivery models of cloud computing
4. categorize the services using Cloud computing
5. apply the security models in the cloud environment
6. develop an automation solution for the cloud

Module 1: Virtualization

Virtualization, Hypervisors, Types of hypervisors. Virtualization techniques - para virtualization - full virtualization, - hardware assisted virtualization - hybrid virtualization, what is virtual machine, server virtualization models, server virtualization platforms Architecture - KVM - Citrix Xen Server - Microsoft Hyper-V - VMware ESx, physical to virtual conversion - VMWare converter - Microfocus Platespin - Microsoft conversion tools - Case Study Open Source p2v conversion tools.

Module 2: Cloud Computing

Overview of Cloud Computing, Characteristics of Cloud , Benefits, limitations, Cloud Deployment Models, Cloud service models-Infrastructure as a service(IaaS), Platform as a Service(PaaS), Software as a Service (SaaS), Anything as a Service(XaaS). OpenStack Private Cloud Architecture, Deployment models, Basic Services - Keystone - Glance - Nova - Cinder - Swift - Horizon, Case Study OpenStack optional services.

Module 3: Cloud Service providers

Google - Google compute engine - Google App Engine, Amazon - Amazon Elastic Compute2(EC2) - Amazon Simple DB - Amazon Simple Storage Service(S3) - Amazon Cloud Front, Case Study - multi tenant vs single tenant - Disaster Recovery

Module 4: Programming Model

Introduction to Hadoop Framework - Mapreduce, Input splitting, map and reduce functions, specifying input and output parameters, configuring and running a job – Developing Map Reduce Applications - Design of Hadoop file system –Setting up Hadoop Cluster, Case Study - Apache Ambari, OpenStack Infrastructure as a code (IaC)

Module 5: Cloud Security

Cloud Infrastructure security: network, host and application level aspects of data security, provider data and its security, Identity and access management architecture, IAM practices in the cloud, SaaS, PaaS, IaaS availability in the cloud - Key privacy issues in the cloud –Cloud Security and Trust Management, Case Study OpenStack cloud security practices and concepts

Module 6: Automating configuration management using Ansible

How Ansible works, A very simple playbook, running the playbook, Anatomy of playbook, variables and facts, Deploying a web server and database server using ansible playbook, Case Study dynamic configuration management using salt stack

Reference Books:

1. Mathew Portony, "Virtualization Essentials", Second Edition, 2016, Sybex, ISBN-13: 978-1119267720
2. Danielle Ruest, Nelson Ruest, "Virtualization: A Beginner's Guide", 2009, McGraw-Hill Osborne Media, ASIN: B01FIXT8YC
3. Toby Velte, Anthony Velte, Robert Elsenpeter, "Cloud Computing, A Practical Approach", 2009, McGraw-Hill Osborne Media, ASIN: B00ME3OQP6
4. John W. Rittinghouse, James F. Ransome, "Cloud Computing Implementation, Management, and Security", First Edition, 2009, CRC Press, ISBN-13: 978-1439806807
5. Lorin Hochstein, Rene Moser, "Ansible: Up and Running: Automating Configuration Management and Deployment the Easy Way", 2017, "O'Reilly Media, Inc.", ISBN-13: 978-1491979808
6. Dan Radez, "OpenStack Essentials" - Second Edition, 2016, ISBN: 1786462206

18CS3016	Cloud Computing and IOT	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the differences between traditional deployment and cloud computing.
2. learn the concepts about Internet of Things.
3. recognize the IoT Reference Architecture and Real World Design Constraints

Course Outcomes:

The student will be able to

1. examine IoT Architecture and various protocols.
2. classify the IoT value chain structure (device, data cloud), application areas and technologies involved. Understand IoT market perspective.
3. design, develop and implement smart systems.
4. infer the advantages of Cloud Services.
5. learn about optimization of cloud storage.
6. apply various kinds of security mechanisms.

Module 1: Introduction

Introduction-Third ICT Wave-IoT Kaleidoscope-Defining IoT-A Web 3.0 View-Panoramic View of IoT Applications-Important Vertical IoT Applications-Horizontal, Vertical and Four Pillars-M2M Internets of Devices-RFID-Internet of Objects-WSN: Internet of Transducers-SCADA: Internet of Controllers.

Module 2: IoT and Middleware of IoT

DCM, Connect Via Pervasive Networks-Wired Networks-Wireless Networks-Satellite IoT-Manage to Create Business Value-Overview For Middleware-Communication Middleware for IoT-MTC/M2M

Middleware-SCADA Middleware-RFID Middleware-WSN Middleware-LBS and Surveillance Middleware.

Module 3: Protocol and Architecture for IoT

Web of Things Versus Internet of Things-IoT Protocol Standardization Efforts-Unified data standards-Platform middleware for WoT-Unified Multi-Tier WoT Architecture-WoT Portals and Business Intelligence-Challenges of IoT Information Security.

Module 4: Cloud of Things

Cloud computing-Grid/SOA and Cloud Computing-Cloud Middleware-NIST's SPI Architecture and Cloud Standards-Cloud Providers and Systems-Internet of Things and Cloud Computing-Mobile Cloud Computing-MAI versus XaaS-Cloud of Things Architecture.

Module 5: Deployment Models of Cloud in IoT

Deployment models of Cloud computing in IoT-Implications of Cloud Computing in view of Deployment-Issues for Deployment and Optimization-Convergence of Cloud and IoT-Data Security-Reliability-Resource Provisioning-Service Level Agreement-Quality of Service-Privacy and Device Integration.

Module 6: Security and Privacy requirements

Security issues in Trust Management Systems-Security Analysis of IoT Related Standard Protocols-Security Threats at Different Layers of IoI-Need for Standardization Bodies for IoT and Cloud.

Reference Books:

1. Honbo Zhou, "The Internet of Things in the Cloud: A Middleware Perspective", 2013, CRC press, ISBN 978-1-4398-9299-2.
2. Pradeep Tomar, Gurjit Kaur," Examining Cloud Computing Technologies Through the Internet of Things (Advances in Wireless Technologies and Telecommunication)", IGI Global, 2018, 1st Edition, ISBN-13: 978-1522534457, ISBN-10: 1522534458.
3. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications.
4. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", 1st Edition, VPT, 2014.
5. Fei Hu, "Security and Privacy in Internet of Things (IoTs): Models, Algorithms, and Implementations", CRC press, 2016, ISBN-10: 1498723187, ISBN-13: 978-1498723183.

18CS3017	Cloud Security	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. apply trust-based security model to real-world security problems.
2. learn an overview of the concepts, processes, and best practices needed to successfully secure information within Cloud infrastructures.
3. develop an understanding of the risk and compliance responsibilities and challenges for each cloud type and service delivery model.

Course Outcomes:

The student will be able to

1. identify security aspects of each cloud model
2. know the standards and protocols for cloud services
3. develop a risk-management strategy for moving to the Cloud
4. implement a public cloud instance using a public cloud service provider
5. apply audit and compliance rules in the cloud environment
6. summarize the recent technologies in cloud security

Module 1: Security Issues in Cloud Computing

Infrastructure Security: The Network Level, The Host Level, The Application Level, Data Security and Storage, Aspects of Data Security, Data Security Mitigation Provider Data and Its Security.

Module 2: Identity and Access Management
Trust Boundaries and IAM, IAM Challenges, Relevant IAM Standards and Protocols for Cloud Services, IAM Practices in the Cloud, Cloud Authorization Management.

Module 3: Security Management in the Cloud
Security Management Standards, Security Management in the Cloud, Availability Management: SaaS, PaaS, IaaS

Module 4: Privacy Issues
Privacy Issues, Data Life Cycle, Key Privacy Concerns in the Cloud, Protecting Privacy, Changes to Privacy Risk Management and Compliance in Relation to Cloud Computing, Legal and Regulatory Implications, U.S. Laws and Regulations, International Laws and Regulations.

Module 5: Audit and Compliance
Internal Policy Compliance, Governance, Risk, and Compliance (GRC), Regulatory/External Compliance, Cloud Security Alliance, Auditing the Cloud for Compliance, Security-as-a-Cloud.

Module 6: Advanced topics
Recent developments in hybrid cloud and cloud security.

Reference Books:

1. Tim Mather, "Cloud Security and Privacy: An Enterprise Perspective on Risks and Compliance", O'Reilly Media , 2009, ISBN-10: 0596802765.
2. Ronald L Krutz, Russell Dean Vines, "Cloud Security-A Comprehensive guide to secure cloud computing", Wiley Publishing, 2010, ISBN: 9780470589878.
3. Raghuram Yeluri, "Building the Infrastructure for Cloud Security-**A Solutions View", Apress Open, 2014,** ISBN-13: 978-1430261452.
4. John Rhoton, "Cloud Computing Explained: Implementation Handbook for Enterprises", Publication, 2009, ISBN: 0956355609

18CS3018	Cloud Simulation Lab	L	T	P	C
		0	0	4	2

Course Objectives:
Enable the student to
1. launch a VM in the cloud. Install applications on VM. Apply various security groups and access the VM using various protocols
2. create, manage volumes, snapshots and networks
3. perform physical to virtual migration using open source tools and automate the deployment of applications using ansible.

Course Outcomes:
The students will be able to
1. remotely accessing and working with the virtual servers in virtual and cloud environments.
2. create private virtual networks
3. manage volumes based data management system.
4. organize the snapshots.
5. deploy services in a virtual workloads
6. develop ansible playbooks to automate the deployment of applications in cloud

List of Experiments
Perform the following in a public cloud (AWS, Google, Azure) or OpenStack Cloud environment
1. Create and launch your first vm and ping it.
2. Create your own website using jekyll and add proper security groups to access the virtual machine.
3. Launch your nginx load balancer to host an apache web server pages
4. Attach a volume to the existing server running jekyll. Store some data and detach it. Take a snapshot of jekyll server and start a new vm using the snapshot.
5. Launch a virtual machine using template

6. Perform a physical to virtual migration using an open source tool
7. Running a word count program using single node hadoop cluster
8. Install a compiler of your choice in a virtual machine and run a sample code
9. Install apache and postgresql servers using ansible playbook.
10. Launch a docker container to run elastic search container and test it

18CS3019	Cluster and Grid Computing	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the concepts of meta-computing, cluster and grid computing.
2. identify the research challenges and design issues in cluster and grid computing.
3. describe the architectures of cluster and grid computing..

Course Outcomes:

The student will be able to

1. recall the functional requirements of grid and cluster computing.
2. compare various web service architectures.
3. identify the issues in cluster computing
4. demonstrate the setting up and administering a cluster
5. evaluate the process scheduling and load balancing policies.
6. elaborate on the recent trends in grid and cluster computing

Module 1: Introduction

Introduction: Cluster and Grid computing, Meta-computing, Web services and Grid Computing, e-Governance and the Grid Technologies and Architectures for Grid Computing: Issues in Data Grids, Functional requirements in Grid Computing, Standards for Grid Computing, Recent technology trends in Large Data Grids. Web Services and the Service Oriented Architecture: Service Oriented Architecture, SOAP and WSDL, Creating Web Services, Server Side.

Module 2: Grid Computing Concepts

OGSA and WSRF: OGSA for Resource Distribution, Stateful Web Services in OGSA, WSRF, WSRF Specification, Globus Toolkit: History, version, Applications, Approaches and Benefits, Infrastructure Management, Monitoring and Discovery, Security, Data Choreography and Coordination, GT4 Architecture, GT4 Containers. The Grid and Databases: Requirements, Storage Request Broker, Integration of Databases with the Grid, Architecture of OGSADAI for offering Grid Database services.

Module 3: Cluster Computing Concepts

Cluster Computing: Approaches to Parallel Computing, Definition and Architecture of a Cluster, Categories of clusters. Cluster Middleware: Levels and Layers of Single System Image, Design objectives, Resource Management and Scheduling, Cluster programming Environment and Tools. Networking, Protocols & I/O for clusters: Networking and Interconnection/Switching Devices, Design Issues, Design Architecture, HiPPI, ATM, Myrinet, Memory Channel.

Module 4: Cluster Management

Setting Up and Administering a Cluster: Setup of simple cluster, setting up nodes, clusters of clusters, System monitoring, Global Clocks Sync. Cluster Technology for High Availability: High availability clusters, high availability parallel computing, types of failures and errors, cluster architectures and configurations for high availability, Failure/Recovery clusters.

Module 5: Process Scheduling and Load Balancing

Process Scheduling: Job management System, Resource management system, policies of resource utilization, Scheduling policies. Load Sharing and Load Balancing: Introduction, Strategies for load balancing, Modelling parameters.

Module 6: Recent Trends

Technologies and attributes in Cluster and Grid computing. Case study of various cluster architectures, load balancing and scheduling policies.

Reference Books:

1. C.S.R. Prabhu, "Grid and Cluster Computing", Prentice Hall Ltd, 2008, ISBN 978-81-203-3428-1.
2. Frederic Magoules, Jie Pan, Kiat-An Tan, Abhinit Kumar, "Introduction to Grid Computing" CRC Press, 2009. ISBN 978-1-4200-7406-2.
3. Barry Wilkinson, "Grid Computing Techniques and Application", CRC Press, 2010. ISBN 978-1-4200-6953- 2.
4. Frederic Magoules, "Fundamentals of Grid Computing", CRC Press, 2010. ISBN: 978-1-4398-0367-7.
5. Rajkumar Buyya, High Performance "Cluster Computing", Pearson, ISBN: 9788131716939, 8131716937, 2007.
6. Dr Z Juhasz Dieter Kranzlmuller, "Distributed and Parallel Systems: Grid and Cluster Computing", Springer,ISBN: 9780387230948, 0387230947,Edition: 2004

18CS3020	Cognitive Wireless Network	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understanding of basics of radio cognitive technology.
2. provides an in depth knowledge of Cognitive wireless networks.
3. explore current cognitive radio technology by researching key areas such as cognitive radio relay networks, sdr, architectures and applications.

Course Outcomes:

The student will be able to

1. understand and acquire knowledge in Cognitive Radio Networks.
2. develop the ability to analyze, design, and implement any application using SDR.
3. apply the concepts of spectrum sensing and spectrum Management.
4. recognize the rapid advances in Cognitive radio technologies.
5. emphasis on knowledge-building to understand architectures for various networks.
6. design a cognitive wireless network with SDR.

Module 1: Introduction

Aware, Adaptive and Cognitive Radios, Cognitive Radio Technology, Cognitive Radio Network Architectures, Cognitive Radio Networks Applications.

Module 2: Cognitive Radio Networks

Network Coding for Cognitive Radio Relay Networks, Cognitive Radio Networks Architecture. Terminal Architecture for CRN. Mathematical Models toward Networking Cognitive Radios. Scaling Laws of CRN.

Module 3: Spectrum Sensing

Spectrum Sensing to detect specific Primary System. Spectrum Sensing for Cognitive Radio OFDMA Systems and Cognitive Multi-Radio Networks.

Module 4: Spectrum Management

Spectrum Management- Spectrum Sharing, Spectrum Pricing, Mobility Management to Heterogeneous Wireless Networks, Regulatory Issues and International Standards.

Module 5: Trusted Cognitive Radio Networks

Framework of Trust in CRN; Trusted Association and Routing; Trust with Learning; Security in CRN.

Module 6: Software Defined Radio

Introduction to SDR. Evolution of SDR Baseband Requirements. SDR Architectures – Ideal SDR Architectures, Realistic SDR Architecture. SDR and Cognitive Radio Relationship.

Reference Books:

1. Kwang-Cheng Chen and Ramjee Prasad, "Cognitive Radio Networks", John Wiley & sons, 2009, ISBN:9780470696897
2. Ahmed Khattab, Dmitri Perkins, Magdy Bayoumi, "Cognitive Radio Networks : From Theory to Practice", Springer, 2013, ISBN 978-1-4614-4033-8.
3. Walter Tuttlebee, "Software Defined Radio- Baseband Technology for 3G Handsets and Base stations", John Wiley @ Sons, 2004, ISBN: 9789828987214

18CS3021	Compiler for HPC	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. recognize the structure of compilers and high performance compiler design for students.
2. explain the concepts of cache coherence and parallel loops in compilers.
3. understand the architecture of modern CPU's and how this architecture influences the way programs should be written.

Course Outcomes

The student will be able to

1. visualize the structure of compilers.
2. describe the parallel loops, data dependency in the compiler.
3. relate and show the Loop Restructuring and Optimizing for Locality of the compiler
4. analyze and evaluate the Concurrency of loops, vector code, exception and debugging
5. evaluate the possibilities of Message-Passing Machines and Shared-Memory Machines
6. design a compiler for a concise programming language

Module 1: High Performance Systems

High Performance Systems, Structure of a Compiler, Programming Language Features, Languages for High Performance.

Module 2: Data Dependence

Data Dependence: Data Dependence in Loops, Data Dependence in Conditionals, Data Dependence in Parallel Loops, Program Dependence Graph. Scalar Analysis with Factored Use-Def Chains: Constructing Factored UseDef Chains, FUD Chains for Arrays, Induction Variables Using FUD Chains, Constant Propagation with FUD Chains, Data Dependence for Scalars. Data Dependence Analysis for Arrays.

Module 3: Loop Restructuring and Optimizing for Locality

Array Region Analysis, Pointer Analysis, I/O Dependence, Procedure Calls, Inter-procedural Analysis. Loop Restructuring: Simple Transformations, Loop Fusion, Loop Fission, Loop Reversal, Loop Interchanging, Loop Skewing, Linear Loop Transformations, Strip-Mining, Loop Tiling, Other Loop Transformations, and Inter-procedural Transformations. Optimizing for Locality: Single Reference to Each Array, Multiple References, General Tiling, Fission and Fusion for Locality.

Module 4: Concurrency Analysis and Vector Analysis

Concurrency Analysis: Concurrency from Sequential Loops, Concurrency from Parallel Loops, Nested Loops, Round off Error, Exceptions and Debuggers. Vector Analysis: Vector Code, Vector Code from Sequential Loops, Vector Code from For all Loops, Nested Loops, Round off Error, Exceptions, and Debuggers, Multi-vector Computers.

Module 5: Message-Passing Machines and Shared-Memory Machines

Message-Passing Machines: SIMD Machines, MIMD Machines, Data Layout, Parallel Code for Array Assignment, Remote Data Access, Automatic Data Layout, Multiple Array Assignments, Other Topics. Scalable Shared-Memory Machines: Global Cache Coherence, Local Cache Coherence, Latency Tolerant Machines.

Module 6: Modern Compiler Design

Recent trends in compiler design for high performance computing and message passing machines and scalable shared memory machine.

Reference Books:

1. Michael Wolfe, High-Performance Compilers for Parallel Computing, Pearson, 19965, ISBN-10: 0805327304; ISBN-13: 978-0805327304
2. David Galles, Modern Compiler Design, Pearson Education 2009, ISBN-10:8131709418
3. Keith Cooper, Linda Torczon, Engineering: A Compiler 2nd Edition, Elsevier, 2012, ISBN-13: 978-0120884780, ISBN-10: 012088478X
4. Randy Allen, Ken Kennedy, Optimizing Compilers for Modern Architectures: A Dependence-based Approach 1st Edition, Horgan Kaufmann Publishers, 2002, ISBN-13: 978-1558602861, ISBN-10: 1558602860
5. Andrew W. Appel, Jens Palsberg, Modern Compiler Implementation in Java, 2nd Edition, Cambridge University Press, 2009, ISBN-13: 978-0521820608, ISBN-10: 052182060X
6. Steven Muchnick, Advanced Compiler Design and Implementation, 1st Edition, 1997, ISBN-13: 978-1558603202, ISBN-10: 1558603204
7. Andrew W. Appel, Modern Compiler Implementation in ML, Press Syndicate of the University of Cambridge, 1999, ISBN-13: 978-0521607643, ISBN-10: 0521607647

18CS3022	Computer Networks and IoT	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. study the different kinds of network
2. understand the IoT Reference Architecture and RealWorld Design Constraints
3. analyze the various IoT Protocols such as Datalink, Network, Transport, Session, Service.

Course Outcomes:

The students will be able to

1. understand the terminology and concepts of the OSI reference model and the TCP-IP reference model.
2. apply different methods for simplification of boolean expressions.
3. infer the vision of IoT from a global context.
4. evaluate the IoT in Market perspective.
5. design and understands state of the art – IoT Architecture.
6. apply the real world IoT design constraints, industrial automation and commercial building automation in IoT.

Module 1: Computer Networks and Internet

Internet, The network edge, The network core, Delay, Loss and Throughput in packet switched networks, Frame relay networks, ATM networks, protocol architecture, ATM logical connections- ATM cell.

Module 2: IoT Overview

IoT, An Architectural Overview, Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals, Devices and gateways, Local and wide area networking, Data management, Business processes in IoT,

Module 3: Reference Architecture

IoT Architecture, State of the Art, Introduction, State of the art, Reference Model and architecture, IoT reference Model, IoT Reference Architecture Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Module 4: Iot Data Link Layer and Network Layer Protocols

PHY/MAC Layer, 3GPP MTC, IEEE 802.11, IEEE 802.15, Wireless HART, Z-Wave, Bluetooth Low Energy, Network Layer-IPv4, DHCP, ICMP

Module 5: Transport and Session Layer Protocols

Transport Layer, TCP, MPTC, UDP, TLS, DTLS, Session Layer HTTP, AMQP, MQTT.

Module 6: Service Layer Protocols and Security

Service Layer, oneM2M, ETSI M2M, Security in IoT Protocols, MAC 802.15.4 , 6LoWPAN, RPL,

Reference Books:

1. William Stallings, "Computer Networking with Internet protocols and Technology", Pearson Education, 6th printing 2011.
2. Jan Holler, VlasiosTsiatsis, Catherine Mulligan, Stefan Avesand, StamatisKarnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014.
3. Peter Waher, "Learning Internet of Things", PACKT publishing, BIRMINGHAM – MUMBAI
4. Bernd Scholz-Reiter, Florian Michahelles, "Architecting the Internet of Things", ISBN 978-3-642-19156-5 e-ISBN 978-3-642-19157-2, Springer
5. Daniel Minoli, "Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communications", ISBN: 978-1-118- 47347-4, Willy Publications
6. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", 1st Edition, VPT, 2014.

18CS3023	Computer Vision	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. describe the concepts of image processing in computer vision.
2. understand the model for application of image analysis to computer vision.
3. apply knowledge in developing applications using computer vision techniques.

Course Outcomes:

The student will be able to

1. define image formation models and light effects in computer vision.
2. identify the feature extraction methodology suitable for computer vision applications.
3. apply the segmentation approaches in image analysis.
4. analyze the motion detection and estimation techniques.
5. construct image analysis models for object recognition.
6. explain the computer vision techniques used for real time applications.

Module 1: Image Formation Models

Monocular imaging system - Orthographic and perspective projection - Camera model and camera calibration - Binocular imaging systems – Perspective - Epipolar geometry - Homography estimation – DLT – RANSAC - 3-D reconstruction framework - Auto-calibration.

Module 2: Feature Extraction

Image representations (continuous and discrete) - Edge detection - Corner detection - Circle and ellipse detection – Textures - Binary shape analysis - Boundary pattern analysis - Shape from texture, color, motion and edges - Light at surfaces - Phong model - Reflectance map - Albedo estimation - Photometric stereo - Use of surface smoothness constraint.

Module 3: Shape Representation and Segmentation

Deformable curves and surfaces - Fourier and wavelet descriptors - Multi-resolution analysis - Region growing - Snakes and active contours - Level set representations - Edge based approaches to segmentation - Mean-shift – MRFs - Graph-cut - Texture segmentation.

Module 4: Motion Detection and Estimation

Regularization theory - Optical computation - Stereo vision - Motion estimation - Background subtraction and modelling - Optical flow – KLT - Spatio-Temporal analysis - Dynamic stereo - Motion parameter estimation - Structure from motion - Motion tracking in video.

Module 5: Object recognition

Hough transforms and other simple object recognition methods - Shape correspondence and shape matching - Principal component analysis - Shape priors for recognition.

Module 6: Applications of Computer Vision

Automated visual inspection - Inspection of cereal grains – Surveillance - Vehicle vision systems – CBIR – CBVR - Activity recognition - Computational photography – Biometrics - Stitching and document processing.

Reference Books:

1. David A. Forsyth and Jean Ponce, "Computer Vision - A modern approach", 2nd Edition, Pearson, 2011. ISBN-13: 978-0136085928
2. Richard Szeliski, "Computer Vision: Algorithms and Applications", 1st Edition, Springer-Verlag London Limited, 2011. ISBN-13: 978-1818829343
3. Linda G. Shapiro, George C. Stockman, "Computer Vision", 1st Edition, Pearson, 2001. ISBN-13: 978-0130307965
4. Rafael C. Gonzalez and Richard E. Woods, "Digital Image Processing, 4th Edition, Pearson, 2017. ISBN-13: 978-0133356724
5. Dana H. Ballard, Christopher M. Brown, "Computer Vision", 1st Edition, Prentice Hall, 1982. ISBN-13: 978-0131653160
6. B. K. P. Horn, "Robot Vision", 1st Edition, McGraw-Hill, 1986. ISBN-10: 007-0303495
7. Emanuele Trucco, Alessandro Verri, "Introductory Techniques for 3-D Computer Vision", Prentice Hall, 1998. ISBN-13: 978-0132611084

18CS3024	Computing Security Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. demonstrate the various ciphers, symmetric and asymmetric techniques.
2. analyze the various network security techniques of scanning, password cracking and sniffing.
3. Design a complete authentication protocol for Internet usage.

Course Outcomes

The student will be able to

1. relate the substitution and transposition techniques used for secure data transmission.
2. defend the network with in-depth understanding of various cryptographic techniques.
3. apply the various cryptographic algorithms for key management and key exchange.
4. experiment the integrity of the message through hashing algorithms and verify the digital signatures.
5. formulate an environment to incorporate anti-intrusion techniques.
6. summarize the security techniques of applicable to computer networks.

List of Experiments

1. Study and implementation of symmetric and asymmetric encryption algorithm for client server data transfer.
2. Study and implementation of hashing techniques
3. Study and implementation of message authentication codes
4. Study and implementation of Key Management and Key exchange.
5. Study and implementation of Digital Signatures.
6. Study and implementation of sniffing of router traffic using Wireshark
7. Study and implementation of Port Scanning techniques.
8. Study and implementation of password cracking and recovery technique.
9. Study and implementation of Anti-Intrusion Technique – Honey pot.
10. Study and implementation of Eavesdropping: Keystroke Logger on a Browser.
11. Study and implementation of IP based Authentication.

18CS3025	Concurrence Parallelism and Distributed System	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. manipulate contemporary knowledge in parallel and distributed systems.
2. analyze and design parallel and distributed applications.
3. measure the performance of parallel and distributed algorithms.

Course Outcomes:

The student will be able to

1. apply the principles and concept in analyzing and designing the parallel and distributed system.
2. design and development of distributed systems and distributed systems applications.
3. prioritize the challenges and opportunities faced by parallel and distributed systems.
4. understand the middleware technologies that support distributed applications.
5. relate the performance and reliability of distributed and parallel programs.
6. demonstrate experience in building large-scale distributed applications.

Module 1: Parallel Computing

Introduction, Parallel Architecture, Architectural Classification Scheme, Performance of Parallel Computers, Performance Metrics for Processors, Parallel Programming Models, Parallel Algorithms. Pipeline processing - Introduction, Pipeline Performance, Arithmetic Pipelines, Pipelined Instruction Processing, Pipeline Stage Design, Hazards, Dynamic Instruction Scheduling,

Module 2: Synchronous Parallel Processing

Introduction, Example-SIMD Architecture and Programming Principles, SIMD Parallel Algorithms, Data Mapping and memory in array processors, Case studies of SIMD parallel Processors

Module 3: Distributed Systems

Design Goals, Types of distributed systems, Distributed Information Systems, Architectures – Architectural styles, Middleware organization, System architecture. Processes – Threads, Virtualization, Clients, Servers, Code Migration

Module 4: Communication

Foundations, Remote procedure call, Message oriented communication, Naming, Flat naming, Structured naming, Structured naming, Attribute based naming, Coordination – Clock synchronization, Logical Clocks, Mutual exclusion, Election Algorithms, Location systems, Distributed event matching, Gossip-based coordination.

Module 5: Consistency and replication

Introduction, Data-centric consistency models, Client-centric consistency models, Replica management, Consistency protocols, Caching and replication in the Web. Fault tolerance - Introduction to fault tolerance, Process resilience.

Module 6: Reliable client-server communication

Reliable group communication, Distributed commit, Recovery. Security - Introduction to security, Secure channels, Access control, Secure naming, Security management.

Reference Books:

1. M.R. Bhujade, Parallel Computing, 2nd edition, New Age International Publishers 2009.
2. Maarten Van Steen, Andrew S. Tanenbaum, Distributed Systems, Third edition, Pearson Education, Inc., 2017, ISBN: 978-15-430573-8-6, ISBN: 978-90-815406-2-9
3. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems: Concepts and Design, Fourth Edition, Addison Wesley/Pearson Education.
4. Pradeep K Sinha, "Distributed Operating Systems: Concepts and design", IEEE computer society press.
5. George Coulouris, Jean Dollimore, Tim Kindberg, Gordon Blair, Distributed systems concept and design, Fifth edition, Pearson Education Ltd, 2012, ISBN: 9870132143011.

6. Arun Kulkarni, Nupur Prasad Giri, Nikhilesh Joshi, Bhushan Jadhav, Parallel and Distributed Systems, second edition, Wiley, 2018, ISBN: 978-81-265-5867-4.
7. I.A.Dhotre, Parallel & Distributed System for UoM, Technical publications, 2016, ISBN-10: 9333208542, ISBN-13: 978-9333208543.

18CS3026	Cyber Forensics	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the importance of cyber forensics and its application to real time scenarios
2. develop knowledge on the legal issues in performing digital forensic
3. anticipate security issues in outsourcing

Course Outcomes:

The student will be able to

1. identify the effect of cybercrime in forensic computing
2. infer digital forensic evidences and investigate the contents
3. choose and apply current computer forensics tools.
4. analyze the nature of cyber terrorism and its effects
5. devise basic computer and network forensic analysis
6. summarize the technical and legal aspects related to cyber crime

Module 1: Introduction

History and evolution- Definition and nature- Forensic Computing: Collection- Investigation and examination of digital evidence - Forensics Investigation- Collection and Examination & Authentication- Response - Cyber terrorism.

Module 2: Crime Related to Unauthorized Access

Hacking - Types of hackers - Examples of hackers- The techniques of hacking- Reasons of hacking- Prevention of hacking- Benefits of hacking- Cybercrimes in financial activities- Cyber terrorism - Electronic-Surveillance

Module 3: Mobile and Wireless Technology

New playgrounds for cyber criminals - The computer and Internet security - Functions related to computer and internet security- Security threat- suggestions for security- Economic Aspects of Computer and Internet security- Internet security and Children- Security Standards for Information Security- Future trends in Security- Blended Attacks- The Future of Wireless.

Module 4: Forensics Investigation

Response- Computer forensics and the law- Cybercrime examples- Forensic evidence- Forensics casework- Preserving the integrity of the crime scene- Investigating incident-Response actions- Forensics analysis investigative actions- Computer forensic tools.

Module 5: Security Issues with Outsourcing

The nondisclosure agreement - Myths about outsourcing security - Security Service level agreements- Developing SLA- Components of an SLA- Adding security to the SLA equation - Future trends in security

Module 6: Legal Aspects of Digital Forensics

IT Act 2000, amendment of IT Act 2008-Recent trends in Cyber forensic technique and methods to search and seizure electronic evidence.

Reference Books:

1. R. K. Chaubey, “An Introduction to cybercrime and cyber law”, Kamal Law House, Second Edition 2014. *ISBN*: 9780111445512
2. John W. Rittinghouse, William M. Hancock, “Cybersecurity Operations Handbook”, Elsevier ISBN-13: 9781555583064, 2005.

3. John R. Vacca, "Computer forensics: Computer Crime Scene Investigation", 2nd Edition, Charles River Media, Inc. Boston, 2005, ISBN-13: 978-1584503897.
4. Nina Godbole, Sunit Belapure, "Cyber security: understanding cybercrimes, computer forensics and legal perspectives", Wiley India Pvt. Ltd., 2011, ISBN-13: 978-8126521791.
5. Raghu Santanam, M. Sethumadhavan, "Cyber Security, Cyber Crime and Cyber Forensics: Applications and Perspectives", Idea Group Inc (IGI), 2011, ISBN: 9781609601256

18CS3027	Cyber Physical Systems	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. recognize the scope and scale of the potential impact of CPS innovation.
2. develop lifelong, sustainable skills and sensibilities for the analysis and design of innovative cyber-physical systems.
3. gain experience with the mathematical modeling and simulation of hybrid systems.

Course Outcomes:

The student will be able to

1. assimilate a conceptual model of the CPS development process.
2. develop an awareness of the different aspects of CPS, including scientific, engineering, and social aspects.
3. explain how to develop a hybrid differential model for cyber-physical systems.
4. judge the suitability of different cyber-physical system designs.
5. master the terminology and communication skills required to reflect on, analyze, and critique development processes.
6. solve the issues that arise when building and validating such models.

Module 1: Introduction and Design Principles of Cyber-Physical Systems

Cyber-Physical Systems Concepts – Design Challenges – Mobile Cyber-Physical Systems – Cyber-Physical System Controls – Cyber-Physical System Security - Smart Grid Example.

Module 2: Medical and Energy Cyber Physical Systems

Introduction – Emergence of CPS – CPS Drivers – Motivation for Medical CPS – System Description and Operational Scenarios – Key Design Drivers and Quality Attributes – Practitioners' Implications – Motivation for Energy CPS - System Description and Operational Scenarios – Key Design Drivers and Quality Attributes – Cyber Paradigm for Sustainable SEES - Practitioners' Implications.

Module 3: Sensor-Based Cyber-Physical Systems

Wireless Sensors and Actuators Networks for Cyber-Physical Systems Applications – Community Sensing – Wireless Embedded/Implanted Microsystems: Architecture and Security – The Application of Machine Learning in Monitoring Physical Activity with Shoe Sensors.

Module 4: Overview of Security and Privacy in Cyber-Physical Systems

Introduction – Defining Security and Privacy – Defining Cyber-Physical Systems – Security and Privacy in CPSs - Examples of Security and Privacy in Action – Approaches to Secure Cyber-Physical Systems – Security and Privacy Challenges for CPSs.

Module 5: Network Security and Privacy for Cyber-Physical Systems

Security and Privacy issues in CPSs – CPS Reference Model – CPS Evolution – Security and Privacy threats in CPSs – Local Network Security for CPSs – Secure Local Communication – Internet Wide Secure Communication – Security and Privacy for cloud-Interconnected CPSs – Securely Processing CPS Data in the cloud – Privacy for Cloud-Based CPSs.

Module 6: Security Issues in Cyber-Physical Systems

Analysis for Security Attacks in Cyber-Physical Systems – Intrusion Detection, Prevention, and Privacy of Big Data for Cyber-Physical Systems – Security in Cyber-Physical Systems: Generalized Framework based on Trust with Privacy

Reference Books:

1. Raj Rajkumar, Dionisio de Niz and Mark Klein, "Cyber Physical Systems", 2017, Pearson Education, Inc, ISBN-13: 978-0-321-92696-8.
2. Houbing Song, Gleena A. Fink and Sabina Jeschke, "Security and Privacy in Cyber-Physical Systems, Foundations, Principles, and Applications", 2018, John Wiley, ISBN: 2017012503.
3. Fei Hu, "Cyber-Physical Systems, Integrated Computing and Engineering Design", 2013, Taylor and Francis Group, ISBN -13: 978-1-4665-7701-5.
4. Gaddadevara Matt Siddesh, Ganesh Chandra Deka etal., "Cyber-Physical Systems, A computational Perspective", 2016, Taylor and Francis Group, ISBN -13: 978-1-4822-5975-9.

18CS3028	Data Center Networking	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. describe the underlying principles of Data Center Networking over the conventional network.
2. explain the data center storage networking standards, its storage technologies.
3. illustrate the virtualization techniques and high performance computing.

Course Outcomes:

The student will be able to

1. describe the principles behind the Data Center Networking over the conventional network.
2. analyze Data Center topologies and virtualized environment
3. explain the data traversal over SDN
4. design algorithms for virtualization over multi-tenant environments
5. survey the various types of key routing and switching techniques used in modern computer networks.
6. distinguish various storage technologies, high-performance computing and recent trends in data center.

Module 1: Data Center Evolution and Switch Fabrics

Networking Basics - Cloud Data Centers and Cloud Networking Characteristics - Mainframes and Servers - Enterprise Cloud and Virtualized Data Centers - Movement to Cloud - Switch Fabric Architecture - Switch Fabric Congestion Management and Flow Control - Switch Fabric Traffic Management - Switch Chip Architecture

Module 2: Cloud Data Center Networking and Standards

Traditional Multi-tiered Enterprise Networks - Data Center Network Switch Types - Flat Data Center Networks - Rack Scale Architectures - Network Function Virtualization - Ethernet Data Rate Standards - Data Center Bridging - Improving Network Bandwidth - Remote Direct Memory Access

Module 3: Virtualization and Networking

Virtual Machines - Virtual Switching - PCI Express and Edge Virtual Bridging - VM Migration - Multi-tenant Environments - Traditional Network Tunneling Protocols - VXLAN and NVGRE Protocols - Tunnel Locations - Load Balancing Algorithms

Module 4: Software-Defined Storage and Networking

Conventional Storages - Advanced Storage Technologies - Storage Communication Protocols - Software-Defined Storage - Storage in Cloud Data Centers - Data Center Software - OpenStack and OpenFlow - Network Function Virtualization - SDN Deployment

Module 5: High-Performance Computing

HPC System Architectures - Multi-socket CPU Boards - HPC Networking Standards - HPC Network Performance Factors - HPC Networking Software.

Module 6: Data Center Trends

Rack Scale Architectures - Memory and Cabling Technology - Switch Fabric Technology - Software-Defined Infrastructure.

Reference Books:

1. Gary Lee,"Cloud Networking - Understanding Cloud-based Data Center Networks", Elsevier, 2014, ISBN: 978-0-12-800728-0.
2. Kevin Corbin, Ron Fuller, David Jansen, "NX-OS and Cisco Nexus Switching: Next-Generation Data Center Architectures", Cisco Press; 1 edition [ISBN: 9781587058929], 2010.
3. Larry L. Peterson, Bruce S. Davie , "Computer Networks – A system approach", Elsevier, 2007, Harcourt Asia PTE LTD, eBook ISBN: 9780080476674
4. Inc. Cisco Systems "Internetworking Technologies Handbook", ILSG Cisco, 2003, ISBN 10: 1587051192, ISBN 13: 9781587051197

18CS3029	Data Encryption and Compression	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the attacks and the basic encryption standards to protect data.
2. analyze the performance of various security mechanisms.
3. demonstrate data compression and encoding.

Course Outcomes:

The student will be able to

1. describe the security and encryption techniques exist in the market,
2. demonstrate different key cryptography and encryption techniques.
3. compare the performance of encryption standards.
4. experiment the techniques of message authentication.
5. examine the different types of compression techniques.
6. correlate the encryption with compression to form the strong security approaches.

Module 1: Security and Encryption Techniques

Need for security, Security approaches, Principles of security, Types of attacks. Plaintext, Cipher text, Substitution & Transposition techniques, Encryption & Decryption, Types of attacks, Key range & Size.

Module 2: Key Cryptography and User Authentication Mechanism

Algorithm types & Modes, DES, IDEA, Differential & Linear Cryptanalysis, RSA, Symmetric & Asymmetric key together, Digital signature, Knapsack algorithm. Authentication basics, Passwords, Authentication tokens, Certificate based & Biometric authentication, Firewall.

Module 3: Public Key Cryptography and Message Authentication

Synchronization, Remote Memory Operations. Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, Key Management.

Module 4: Data Compression

Need for data compression, Fundamental concept of data compression & coding, Communication model, Compression ratio, Requirements of data compression, Classification. Methods of Data Compression: Data compression-- Loss less & Lossy

Module 5: Entropy Encoding

Entropy encoding-- Repetitive character encoding, Run length encoding, Zero/Blank encoding; Statistical encoding-- Huffman, Arithmetic & Lempel-Ziv coding; Source encoding-- Vector quantization (Simple vector quantization & with error term); Differential encoding—Predictive coding, Differential pulse code modulation, Delta modulation, Adaptive differential pulse code modulation; Transform based coding : Discrete cosine transform & JPEG standards; Fractal compression.

Module 6: Case Study

Recent trends in encryption and data compression techniques.

Reference Books:

1. Sean W.Smith, "Trusted Computing Platforms: Design and Applications". Springer, 2005.

2. Khalid sayood, Introduction to Data Compression, Fourth Edition, Elsevier, ISBN:978-0-12-415796-5, 2012.
3. B. Forouzan, "Cryptography and Network Security", McGraw-Hill. ISBN: 9789339220945, 9339220943, 2016.
4. Nelson, "The Data Compression Book", BPB, 1995, ISBN-10: 1558514341,978-1558514348.
5. Atul Kahate, "Cryptography & Network Security", TMHs

18CS3030	Data Preparation and Analysis	L	T	P	C
		3	0	0	3

Course objectives:

Enable the student to

1. learn the basics of data
2. extract the data for performing the Analysis
3. develop models and gain insights from the data.

Course Outcomes

The student will be able to

1. describe and understand the nature of data
2. prepare the data into the required format
3. identify the relationships and group the data
4. build models from the data
5. gain insight from the data
6. deliver the insights through appropriate visualization technique.

Module 1: Introduction and Data Description

Sources of data- Process of making sense of data- Observations and variables-Types of variables- central tendency- Distribution of the data- confidence intervals-hypothesis tests.

Module 2: Data Preparation

Cleaning the Data- Removing Observations and Variables -Generating Consistent Scales Across Variables- New Frequency Distribution- Converting Text to Numbers - Converting Continuous Data to Categories - Combining variables – Generating groups-Preparing unstructured data

Module 3: Identification of Relationships and Groups

Visualizing Relationships Between Variables- Visualizing Relationships Between Variables- Clustering- Association Rules

Module 4: Building Models from data

Linear Regression - Logistic Regression- k-Nearest Neighbors- Classification and Regression Trees

Module 5: Advanced analytical methods: Time Series Analysis

Time series analysis- Box-Jenkins method- ARIMA model- Autocorrelation models- Autoregressive models- Moving average models- ARMA and ARIMA models- Building and Evaluating ARIMA model

Module 6: Text analysis and Data Visualization

Collecting raw text-representing text-Term Frequency Inverse Document Frequency- Categorizing documents by topics-Determining Sentiments-Gaining Insights

Evolution of a Graph- Common representation methods

Reference Books:

1. Glenn J.Matt, Wayne P. Johnson, Making sense of Data : A practical Guide to Exploratory Data Analysis and Data Mining, 2014, Wiley and sons, ISBN : 9781118407417
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC2, Wiley and Sons, 2015 ISBN: 8126556536
3. Jiawei Han, Micheline Kamber, Data Mining Concepts and Techniques, Chris Ullman, Morgan Kaufmann Publishers,Third Edition, 2011, ISBN 0123814790, ISBN-13 9780123814791.
4. Ian H. Witten, Eibe Frank, Data Mining Practical Machine Learning Tools and Techniques,Elsevier, Third Edition, 2011, ISBN: 978-012-374856-0.

5. David Hand, Heikki Mannila and Padhraic Smyth, Principles of Data Mining, The MIT Press, 2001. ISBN-10: 026208290X
6. Max Bramer, Principles of Data Mining, Springer, 2013 ISBN -1447148843
7. Bertrand Clarke, Ernest Fokoue, Hao Helen Zhang, Principles and Theory for Data Mining and Machine Learning, Springer, 2009, ISBN-0387981357

18CS3031	Data Science	L 3	T 0	P 0	C 3

Course Objectives:

Enable the student to

1. understand the statistics and machine learning concepts that are vital for data science;
2. learn to statistically analyze a dataset;
3. critically evaluate data visualization based on their design and use for communicating stories from data

Course Outcomes

The student will be able to

1. understand the key concepts in data science, its applications and the toolkit used by data scientists;
2. explain how data is collected, managed and stored for data science;
3. apply various machine learning techniques in real-world applications
4. implement data collection and management
5. use visualization tools for data visualization
6. possess the required knowledge and expertise to become a proficient data scientist.

Module 1: Introduction to core concepts and technologies

Introduction, Terminology, data science process, data science toolkit, Types of data, Example applications.

Module 2: Data collection and management

Introduction, Sources of data, Data collection and APIs, Exploring and fixing data, Data storage and management, using multiple data sources

Module 3: Data analysis

Introduction, Terminology and concepts, Introduction to statistics, Central tendencies and distributions, Variance, Distribution properties and arithmetic, Samples/CLT, Basic machine learning algorithms, Linear regression, SVM, Naive Bayes.

Module 4: Data visualization

Introduction, Types of data visualization, Data for visualization: Data types, Data encodings, Retinal variables, Mapping variables to encodings, Visual encodings.

Module 5: Applications

Applications of Data Science, Technologies for visualization

Module 6: Recent Technologies

Recent trends in various data collection and analysis techniques, various visualization techniques, application development methods of used in data science.

Reference Books:

1. Cathy O'Neil and Rachel Schutt, Doing Data Science, Straight Talk from The Frontline. O'Reilly, 2014. ISBN: 978-1-449-35865-5
2. Joel Grus, Data Science from Scratch, O'Reilly, 2015, ISBN: 978-1-491-90142-7
3. Jure Leskovek, Anand Rajaraman and Jeffrey Ullman, Mining of Massive Datasets. v2.1, Cambridge University Press, 2014. ISBN : 9781139924801
4. Davy Cielen. Arno D.B Meysman, Mohamed Ali, "Introducing Data Science", Dreamtech Press, 2016. ISBN: 978-93-5119-937-3

5. John W. Foreman, Using Data Science to Transform Information into Insight – Data Smart, Wiley, 2014. ISBN: 978-81-265-4614-5

18CS3032	Data Science Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. apply the knowledge gained on theoretical and practical aspects of data mining and machine learning techniques to solve practical problems.
2. identify the relevant technique and tool to provide solution.
3. design, implement and evaluate the model output using different performance metrics

Course Outcomes:

The student will be able to

1. summarize the concepts of data mining and machine learning techniques
2. demonstrate the steps involved in the development of the system.
3. identify the relevant programming platform and toolbox to implement the pre and post processing techniques, data mining and machine learning techniques.
4. analyze the problem thoroughly and identify the appropriate technique to design the model
5. design and implement the computing systems using appropriate technique and tools for any real-world application and recommend the best approach.
6. evaluate and compare the performance of different approaches for a given problem.

List of Experiments

1. Write a program to preprocess the dataset to remove missing values, outliers and to transform and discretize the dataset.
2. Write a program to identify the relationship between the attributes using correlation coefficient technique
3. Write a program to implement the classification techniques: Decision Tree and Naïve Bayes algorithms and compare its performance.
4. Write a program to implement K-Means and K-Medoids clustering algorithms
5. Write a program to implement Apriori algorithm to derive association rules.
6. Write a program to classify the input dataset using multiple layer perceptron (MLP) trained using backpropagation algorithm (BPA)
7. Write a program to classify the input dataset using Radial Basis Function (RBF) algorithm
8. Write a program to classify the input dataset using Support Vector Machine (SVM)
9. Write a program to demonstrate clustering approach using Kohonen's self-organizing map
10. Write a program to prove the stability plasticity dilemma of Adaptive Resonance Theory clustering approach compared to MLP BPA
11. Write a program to implement Hopfield Network
12. Write a program to implement Principal Component Analysis (PCA) technique to reduce the dimensionality of the dataset
13. Write a program to implement a simple Convolutional Neural Network (CNN) to classify simple images.

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS3033	Data Visualization	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. familiarize students with the basic and advanced techniques of information visualization and scientific visualization,
2. learn key techniques of the visualization process

3. understand the detailed view of visual perception, the visualized data and the actual visualization, interaction and distorting techniques

Course Outcomes:

The student will be able to

1. familiar with the design process to develop visualization methods and visualization systems, and methods for their evaluation.
2. preparation and processing of data,
3. have an understanding of large-scale abstract data
4. understand visual mapping and the visualization
5. create actual visualization, interaction and distorting techniques
6. keep track of recent visual perception techniques

Module 1: Introduction of visual perception, visual representation of data, Gestalt principles, Information overloads.

Module 2: Creating visual representations, visualization reference model, visual mapping, visual analytics, Design of visualization applications.

Module 3: Classification of visualization systems, Interaction and visualization techniques misleading, Visualization of one, two and multi-dimensional data, text and text documents.

Module 4: Visualization of groups, trees, graphs, clusters, networks, software, Metaphorical visualization

Module 5: Visualization of volumetric data, vector fields, processes and simulations, Visualization of maps, geographic information, GIS systems, collaborative visualizations, Evaluating visualizations

Module 6: Recent trends in various perception techniques, various visualization techniques, data structures used in data visualization.

Reference Books:

1. Ward, Grinstein, Keim, "Interactive Data Visualization: Foundations, Techniques, and Applications" Second Edition, 2015, CRC Press.
2. E. Tufte, "The Visual Display of Quantitative Information", 2001, Graphics Press.

18CS3034	Data Warehouse and Data Mining	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the students to

1. introduce data warehousing and mining techniques.
2. apply data mining in web mining, pattern matching
3. understand the cluster analysis of broad data mining areas.

Course Outcomes:

The student will be able to:

1. study of different sequential pattern algorithms
2. study the technique to extract patterns from time series data and it application in real world.
3. elaborate the graph mining algorithms to web mining
4. identify the computing framework for big data
5. mine the data streams for imbalance problems
6. understand the recent warehousing and data mining techniques

Module 1: Introduction to Data Warehousing

Data Mining: Mining frequent patterns, association and correlations; Sequential Pattern Mining concepts, primitives, scalable methods;

Module 2: Classification and prediction

Cluster Analysis – Types of Data in Cluster Analysis, Partitioning methods, Hierarchical Methods; Transactional Patterns and other temporal based frequent patterns,

Module 3: Mining Time Series Data
Mining Time series Data, Periodicity Analysis for time related sequence data, Trend analysis, and Similarity search in Time-series analysis;
Module 4: Mining Data Streams
Methodologies for stream data processing and stream data systems, Frequent pattern mining in stream data, Sequential Pattern Mining in Data Streams, Classification of dynamic data streams, Class Imbalance Problem; Graph Mining; Social Network Analysis;
Module 5: Web Mining
Mining the web page layout structure, mining web link structure, mining multimedia data on the web, Automatic classification of web documents and web usage mining; Distributed Data Mining.
Module 6: Recent Trends
Recent trends in Distributed Warehousing and Data Mining, Class Imbalance Problem; Graph Mining; Social Network Analysis

Reference Books:

1. Jiawei Han and M Kamber, Data Mining Concepts and Techniques, Second Edition, Elsevier Publication, 2011.
2. Vipin Kumar, Pang-Ning Tan Michael Steinbach "Introduction to Data Mining", Addison Wesley, 2006.
3. G Dong and J Pei, "Sequence Data Mining", Springer, 2007.

18CS3035	Database Security and Access Control	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. understand the fundamentals of security, and how it relates to various access control techniques.
2. explore the various database security models and their advantages or disadvantages.
3. gain an overview of access control techniques mechanisms along with application areas of access control techniques.

Course Outcomes:
The student will be able to
1. understand and implement classical security models and algorithms.
2. identify the problems, and choose the relevant models and algorithms to apply.
3. assess the strengths and weaknesses of various access control models and to analyze their behavior.
4. design secure database systems in their network.
5. relate and audit a customer's network database security problems.
6. describe the vulnerabilities to database system

Module 1: Introduction
Introduction to Access Control, Purpose and fundamentals of access control, brief history,
Module 2: Policies of Access Control
Policies of Access Control, Models of Access Control, and Mechanisms, Discretionary Access Control (DAC), Non- Discretionary Access Control , Mandatory Access Control (MAC). Capabilities and Limitations of Access Control Mechanisms: Access Control List (ACL) and Limitations, Capability List and Limitations,
Module 3: Role-Based Access Control (RBAC)
Role-Based Access Control (RBAC) and Limitations, Core RBAC, Hierarchical RBAC, Statically Constrained RBAC, Dynamically Constrained RBAC, Limitations of RBAC. Comparing RBAC to DAC and MAC Access control policy,
Module 4: Models and Features
Biba'sintrigity model, Clark-Wilson model, Domain type enforcement model , mapping the enterprise view to the system view, Role hierarchies- inheritance schemes, hierarchy structures and inheritance

forms, using SoD in real system, Temporal Constraints in RBAC, MAC AND DAC. Integrating RBAC with enterprise IT infrastructures: RBAC for WFMSs, RBAC for UNIX and JAVA environments Case study: Multi line Insurance Company.

Module 5: Smart Card

Smart Card based Information Security, Smart card operating system fundamentals, design and implantation principles, memory organization, smart card files, file management, atomic operation, smart card data transmission ATR,PPS Security techniques- user identification , smart card security, quality assurance and testing , smart card life cycle-5 phases, smart card terminals.

Module 6: Recent Trends in Database Security

Recent trends in Database security and access control mechanisms. Case study of Role-Based Access Control (RBAC) systems.

Reference Books:

1. David F. Ferraiolo, D. Richard Kuhn, Ramaswamy Chandramouli,Role-Based Access Control, 2nd Edition Kindle Edition,2007
2. Ron Ben Natan, Implementing Database Security and Auditing, Elsevier, 1st Edition,2005. ISBN: 9781555583347.
3. Charles P. Pfleeger, Shari Lawrence Pfleeger, Security in Computing, Pearson Education Asia, Third edition, 2003. ISBN: 81-297-0042-5.
4. Ferraiolo D.F., Cugini J.A., Kuhn R.D.: Role-Based Access Control: Features and Motivations. Proceedings of the 11th Annual Computer Security Applications Conference, 2014.

18CS3036	Design and Analysis of Networks	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the process involved in requirement analysis
2. choose the suitable architecture
3. design the network

Course Outcomes:

The student will be able to

1. define requirement analysis concepts
2. demonstrate the requirement analysis process
3. evaluate and perform flow analysis
4. choose architecture like network, addressing & routing and network management
5. evaluate the performance architecture and security & privacy architecture
6. propose the apt network design

Module 1: Introduction and Requirement analysis concepts

Overview of analysis, architecture, and design process – systems methodology – system description – service description – service characteristics – performance characteristics – network supportability – user requirements – application requirements – device requirements – network requirements – other requirements – the requirements specification and map

Module 2: Requirement analysis process

objectives – gathering and listing requirements – developing service metrics – characterizing behavior – developing RMA requirements – developing delay requirements – developing capacity requirements – developing supplemental performance requirements – environmental specific thresholds and limits – requirements for predictable and guaranteed performance

Module 3: Flow analysis and network architecture

Flows – Identifying and developing flows – data sources and sinks – flow models – flow prioritization – flow specification – component architectures – reference architecture – architectural models – systems and network architectures

Module 4: Addressing and Routing architecture and network management architecture
Addressing mechanism – routing mechanism – addressing strategies – routing strategies – architectural considerations – defining network management – network management mechanisms – architectural considerations

Module 5: Performance architecture and security and privacy architecture
Developing goals for performance – performance mechanism – architectural considerations – developing security and privacy plan – security and privacy mechanisms – architectural considerations

Module 6: Network design
Design concepts – design process – vendor, equipment, and service-provider evaluations – network layout – design traceability – design metrics

Reference Books:

1. Network Analysis, Architecture, and Design, By James D. McCabe, 3rd edition, Morgan Kauffman, ISBN: 9788131212592, 8131212599
2. Computer-communication network design and analysis, by Mischa Schwartz, Prentice-Hall, ISBN-10: 013165134X, 978-0131651340
3. Practical Computer Network Analysis and Design, by James D. McCabe, Morgan Kaufmann Publishers
4. Algorithmics of Large and Complex Networks: Design, Analysis, and Simulation, by Jurgen, Dorothea & Katharina, Springer.

18CS3037	Design and Analysis of Networks Lab	L	T	P	C
		0	0	4	2

Course Objectives:
Enable the student to
1. understand the functioning of various protocols in Wireless Environment.
2. understand the functioning of IP network
3. understand about the mobile ad hoc network

Course Outcomes:
The student will be able to
1. understand the functioning of various protocols in Wireless Environment.
2. recognize the IP networking principles
3. understand about the mobile ad hoc network.
4. simulate the working principles of wireless communication.
5. design management module for the wireless network
6. analyze the performance of routing algorithms.

List of Experiments
1. Implement wireless to wireless communication using wireless protocol
2. Implement and test Wireless Network Design with Small World Properties.
3. Implement Packet Data Protocol wireless communication.
4. Implement IP Networks protocol.
5. Simulating a Mobile Adhoc Network.
6. Simulating a Wi-Fi Network.
7. Simulating a Wireless Sensor Network.
8. Implement Transport Control Protocol in Sensor Network.
9. Implement applications using TCP & UDP sockets like
   (i) DNS (ii)SNMP (iii) File Transfer
10. Implement different routing protocols to select the network path with its optimum energy and cost during data transfer
    (ii) Link state routing (ii) Flooding (iii) Distance vector

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS3038	Digital Forensics	L 3	T 0	P 0	C 3

Course Objectives:

Enable the student to

1. appraise an in-depth study of the rapidly changing and fascinating field of computer forensics
2. summarizes both the technical expertise and the knowledge required to investigate, detect and prevent digital crimes
3. describes E-evidence collection and preservation, investigating operating systems and file systems, network forensics, art of steganography and mobile device forensics

Course Outcomes

The student will be able to

1. understand relevant legislation and codes of ethics.
2. comply Computer forensics, digital detective and various processes, policies and procedures.
3. practice E-discovery, guidelines and standards, E-evidence, tools and environment.
4. paraphrase Email, web forensics and network forensics.
5. obtain the knowledge on digital forensics legislations.
6. apply the art of steganography and mobile device forensics.

Module 1: Digital Forensics Science

Forensics science, computer forensics, digital forensics, Criminalistics as it relates to the investigative process, analysis of cyber-criminalistics area, holistic approach to cyber-forensics

Module 2: Cyber Crime Scene Analysis

Discuss the various court orders etc., methods to search and seizure electronic evidence, retrieved and un-retrieved communications, Discuss the importance of understanding what court documents would be required for a criminal investigation.

Module 3: Evidence Management & Presentation

Create and manage shared folders using operating system, importance of the forensic mindset, define the workload of law enforcement, Explain what the normal case would look like, Define who should be notified of a crime, parts of gathering evidence, Define and apply probable cause.

Module 4: Computer Forensics

Prepare a case, Begin an investigation, Understand computer forensics workstations and software, Conduct an investigation, complete a case, Critique a case, open-source security tools for network forensic analysis, requirements for preservation of network data.

Module 5: Legal Aspects of Digital Forensics

Mobile forensics techniques, mobile forensics tools, IT Act 2000, amendment of IT Act 2008.

Module 6: Mobile forensic techniques

Recent trends in mobile forensic technique and methods to search and seizure electronic evidence

Reference Books:

1. John Vacca, Computer Forensics: Computer Crime Scene Investigation, Laxmi Publications, ISBN-10: 1584503890, 978-1584503897
2. R.K. Chaubey, An Introduction to cybercrime and cyber law, Kamal Law House, second edition 2014. ASIN: B007HGB3U6.
3. John Sammons, The Basics of Digital Forensics, Elsevier
4. Michael Sikorski, Andrew Honig "Practical Malware Analysis: The Hands-On Guide to Dissecting Malicious Software" publisher William Pollock

18CS3039	Distributed Databases	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. provide insight to distributed database, normalization techniques
2. understand the database integrity rules.
3. apply parallel database systems along with object oriented models.

Course Outcomes:

The student will be able to

1. understand relational database management systems,
2. apply normalization to make efficient retrieval from database and query.
3. understand the distributed DBMS architecture
4. understand the query processing schemes
5. find the parallel execution for hierarchical architecture
6. learn the latest models and approaches in distributed database

Module 1: Introduction

Distributed Data processing, Distributed database system (DDBMS),
Promises of DDBMSs, Complicating factors and Problem areas in DDBMSs, Overview Of Relational DBMS Relational Database concepts, Normalization, Integrity rules, Relational Data Languages, Relational DBMS.

Module 2: Distributed DBMS Architecture

DBMS Standardization, Architectural models for Distributed DBMS, Distributed DBMS Architecture. Distributed Database Design: Alternative design Strategies, Distribution design issues, Fragmentation, Allocation. Semantic Data Control: View Management, Data security, Semantic Integrity Control.

Module 3: Overview of Query Processing

Query processing problem, Objectives of Query Processing, Complexity of Relational Algebra operations, characterization of Query processors, Layers of Query Processing. Introduction to Transaction Management: Definition of Transaction, Properties of transaction, types of transaction. Distributed Concurrency Control: Serializability theory, Taxonomy of concurrency control mechanisms, locking bases concurrency control algorithms.

Module 4: Parallel Database Systems

Database servers, Parallel architecture, Parallel DBMS techniques, Parallel execution problems, Parallel execution for hierarchical architecture.

Module 5: Distributed Object Database Management Systems

Fundamental Object concepts and Object models, Object distribution design. Architectural issues, Object management, Distributed object storage, Object query processing. Transaction management. Database Interoperability: Database Integration, Query processing.

Module 6: Recent Trends

Recent approaches, models and current trends in improving the performance of Distributed Database.

Reference Books:

1. M. Tamer Ozsu Patrick Valduriez, Principles of Distributed Database Systems, Second Edition, 2011, Springer
2. Stefano Ceri, Giuseppe Pelagatti, Distributed Databases principles and systems, 2008, Tata McGraw Hill.

18CS3040	Distributed Systems	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. describe the concepts of resource sharing, system modeling, inter-process communication and file systems in distributed systems.
2. apply the skill sets in name services and global states, distributed transaction and concurrency control model, distributed shared memory and distributed multimedia system.
3. compare the replication techniques and shared memory schemes in distributed systems.

Course Outcomes:

The student will be able to

1. describe the distributed system models.
2. distinguish between different inter-process communication mechanisms and their application scenarios.
3. illustrate a transaction and concurrency control scheme for a real time application.
4. compare the various file system architectures used in distributed systems
5. construct a real time distributed system with suitable IPC, event coordination, file management, name service, transaction and concurrency control mechanisms.
6. evaluate an efficient distributed system and its qualities.

Module I - Introduction:

Introduction to Distributed systems - Examples of distributed systems, resource sharing and the web, challenges - System model - introduction - architectural models - fundamental models - Introduction to inter-process communications - API for Internet protocol - external data.

Module II - Distributed objects and file systems:

Introduction - Communication between distributed objects - Remote procedure call - Events and notifications - case study - Operating system support - introduction - operating system layer - protection - process and threads - communication and invocation - architecture - Introduction to DFS - File service architecture - Sun network file system - Andrew file system - Enhancements and future developments.

Module III - Name services and global states:

Introduction to Name Services- Name services and DNS - Directory services - case study - Introduction to peer-to-peer systems - Napster Department of Computer Science and Engineering 4 and its legacy - Peer-to-peer middleware - Routing overlays - case study - Introduction to time and global states - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical clocks - Global states - Distributed debugging.

Module IV - Distributed transaction and concurrency control:

Introduction to coordination and agreement - Distributed mutual exclusion - elections - multicast communication - consensus and related problems - Introduction to transaction and concurrency control - Transactions - Nested transaction - Locks - Optimistic concurrency control - Timestamp ordering - Comparison of methods for concurrency control - Introduction to distributed transactions - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery.

Module V - Replication, distributed shared memory: Introduction to Replication - System model and group communications - Fault tolerant services - Highly available services - Transactions with replicated data - Distributed shared memory - design and implementation issues - sequential consistency and Ivy - release consistency and Munin - other consistency models-

Module 6 - distributed multimedia system

Distributed multimedia systems - characteristics of multimedia data - quality of service management - resource management - stream adaptation - case study.

Reference Books:

1. George Coulouris, Jean Dollimore, and Tim Kindberg, Distributed Systems Concepts and Design, Fifth edition, Addison-Wesley, 2011. ISBN: 0132143011.

2. Andrew S. Tanenbaum and Maartenvan Steen, Distributed Systems: Principles and Paradigms, Second edition, Prentice Hall, 2006. ISBN: 0132392275.
3. William Buchanan, Distributed Systems and Networks, McGraw-Hill, 2001.ISBN: 0077095839.
4. Pradeep K. Sinha, Distributed Operating Systems: Concepts and Design, Wiley- IEEE Press, 1996. ISBN: 0780311191.

18CS3041	DNA Computing	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the basic concepts of DNA computing
2. identify the mathematical theory involved in DNA computing
3. demonstrate applications of DNA computing.

Course Outcomes:

The student will be able to

1. understand DNA sequence matching algorithms.
2. describe the parallelism in DNA computing algorithms.
3. use mathematical theory for DNA computing
4. employ language theory for DNA computing
5. illustrate various techniques to apply parallelism for DNA computing
6. apply DNA computing in Computer Networks

Module 1: Introduction

Introduction: DNA Structure, Sequence and Processing of DNA Introduction to molecular computing

Module 2: Introduction to Formal Language Theory

Basic Notations, Grammars, Automata, Grammar Systems – Characterizations of Recursively Enumerable Languages, Universal Turing Machines and Type-0 Grammars;

Module 3: Sticker Systems

Operation of sticking – Sticker systems classifications – The generative capacity of sticker systems – Representations of Regular and Linear Languages – Characterizations of Recursively Enumerable Languages – More about Regular Sticker Systems

Module 4: Watson Crick Automata

Watson Crick Automata – Relationship between the WK families - Characterizations of Recursively Enumerable Languages - Watson Crick Transducers – Further variants of Watson Crick Finite Automata - Watson Crick Automata with a Watson Crick memory – Universal Results for Watson Crick Automata;

Module 5: Insertion-Deletion Systems and Splicing Systems

Insertion-Deletion Systems: Inserting and deleting in the DNA framework - Characterizations of Recursively Enumerable Languages – One symbol Insertion-deletion systems; Splicing circular strings: From DNA recombination to the Splicing operation – Non-iterated splicing as an operation with Languages - Iterated splicing as an operation with Languages.

Module 6: Distributed H Systems

Splicing Grammar Systems – Communicating Distributed H Systems – Two-Level Distributed H Systems – Time varying Distributed H Systems – Applications of DNA computing in Computer Networks

Reference Books:

1. Paun, Gheorghe, Rozenberg, Grzegorz, Salomaa, Arto, DNA Computing", Springer publication, (2012) ISBN: 3662035642, 9783662035641
2. James D. Watson, Michael Gilman, Jan Witkowski, Mark Zoller, "Recombinant DNA", W. H. Freeman and Company (1993) ISBN 10: 0716722828 ISBN 13: 9780716722823

18CS3042	Ethical Hacking	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. introduce students to the fundamentals of ethical hacking
2. learn about different tools and techniques in Ethical hacking and security
3. explore different methods in ethical hacking analysis

Course Outcomes

The student will be able to

1. learn how to apply knowledge of engineering to security evaluations and design
2. understand the impact of security practices in a global and societal context
3. defend a computer against different types of security attacks
4. practice and use safe techniques on the World Wide Web
5. appreciate the Cyber Laws and impact of hacking
6. exploit the vulnerabilities related to computer system and networks using state of the art tools and technologies

Module 1: Introduction to Ethical Disclosure

Ethics of Ethical Hacking, Ethical Hacking and the legal system, Proper and Ethical Disclosure

Module 2: Penetration Testing and Tools

Social Engineering attacks, Physical penetration attacks, Insider attack, Using Metasploit, Using BackTrack Linux Distribution

Module 3: Vulnerability Analysis I

Passive Analysis, Advanced Static Analysis with IDA Pro, Advanced Reverse Engineering

Module 4: Vulnerability Analysis II

Client-side browser exploits, Exploiting Windows Access Control Model for Local Elevation Privilege, Intelligent Fuzzing with Sulley, From Vulnerability to Exploit

Module 5: Malware Analysis

Collecting Malware and Initial Analysis

Module 6: Case Study

Case study of certain vulnerability found in cloud platforms and mobile platforms & devices.

Reference Books:

1. Allen Harper, Shon Harris, "Gray Hat Hacking The Ethical Hackers Handbook", Third Edition, McGraw Hill Education, 2011, IBSN-13: 978-0071742559
2. Jon Erickson, "Hacking: The Art of Exploitation",2nd Edition, SPD,2008, ISBN-13: 978-1-59327-144-2
3. Michael T. Simpson, Kent Backman, James Corley, Hands - On Ethical Hacking And Network Defense, Delmar Cengage Learning, 2012, ISBN-13: 978-1133935612
4. Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Second Edition, Wiley, 2011, ISBN-13: 978-1118026472.
5. Stuart Mcclure, Joel Scambray, George Kurtz, Hacking Exposed 7: Networking Security Secrets and Solutions, Seventh Edition McGraw Hill Education, 2012. ISBN-13: 978-0071780285

18CS3043	GPU Computing	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. study architecture and capabilities of modern GPUs
2. learn parallel programming with Graphics Processing Units (GPUs)
3. understand every aspect of parallel computing and parallel algorithm.

Course Outcomes

The student will be able to

1. learn basic concepts in parallel programming,
2. discuss the communication models in parallel algorithm
3. implement programs on GPUs, debug and profiling parallel programs.
4. identify memory implementation on GPU Processing,
5. illustrate traditional computer science algorithms as well as accelerated computing algorithms.
6. evaluate various parallel algorithms on GPU Processors.

Module 1: Introduction

History, Graphics Processors, Graphics Processing Units, GPGPUs. Clock speeds, CPU / GPU comparisons, Heterogeneity, Accelerators, Parallel programming, CUDA OpenCL / OpenACC, Hello World Computation Kernels, Launch parameters, Thread hierarchy, Warps / Wavefronts, Thread blocks / Workgroups, Streaming multiprocessors, 1D / 2D / 3D thread mapping, Device properties, Simple Programs

Module 2: Memory

Memory hierarchy, DRAM / global, local / shared, private / local, textures, Constant Memory, Pointers, Parameter Passing, Arrays and dynamic Memory, Multi-dimensional Arrays, Memory Allocation, Memory copying across devices, Programs with matrices, Performance evaluation with different memories

Module 3: Synchronization

Memory Consistency, Barriers (local versus global), Atomics, Memory fence. Prefix sum, Reduction. Programs for concurrent Data Structures such as Worklists, Linked-lists. Synchronization across CPU and GPU Functions: Device functions, Host functions, Kernels functions, Using libraries (such as Thrust), and developing libraries.

Module 4: Support Streams

Debugging GPU Programs. Profiling, Profile tools, Performance aspects Streams: Asynchronous processing, tasks, Task-dependence, overlapped data transfers, Default Stream, Synchronization with streams. Events, Event-based Synchronization - Overlapping data transfer and kernel execution, pitfalls.

Module 5: Case Studies

Image Processing, Graph algorithms, Simulations, Deep Learning

Module 6: Advanced topics: Real Time applications

Dynamic parallelism, Unified Virtual Memory, Multi-GPU processing, Peer access, Heterogeneous processing

Reference Books:

1. Programming Massively Parallel Processors: A Hands-on Approach; David Kirk, Wen-meiHwu; Morgan Kaufman; 2010 (ISBN: 978-0123814722)
2. J. Sanders and E. Kandrot, CUDA by Example: An Introduction to General- Purpose GPU Programming, nvidia, (2011)
3. CUDA Programming: A Developer's Guide to Parallel Computing with GPUs; Shane Cook; Morgan Kaufman; 2012 (ISBN: 978-0124159334)
4. David B. Kirk, Wen-mei W. Hwu. Programming Massively Parallel Processors: A Hands-on Approach. Morgan Kaufmann, (2010).
5. Peter Arbenz, Wesley Petersen, W.P. Petersen, Introduction to Parallel Computing, 2008, Oxford, ISBN- 13: 9780199560868
6. Michael J. Quinn, Parallel Computing: Theory and practice, Second edition, Reprint 2008, Tata McGraw - Hill Education, ISBN-13: 9780070495463.
7. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, Second Edition, Reprint 2012, Pearson Education, ISBN-13: 9788131708071
8. Roman, Peter, Parallel Computing: Numerics, Applications, and Trends, 2010, ISBN-13: 9781849968416.

18CS3044	High Performance Computing	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the concepts of Modern Processors.
2. recognize the various kinds of optimization techniques for serial code.
3. apply parallel programming using OpenMP and MPI.

Course Outcomes:

The student will be able to

1. recall the concepts used in Modern Processors for increasing the performance.
2. identify Optimization techniques for serial code.
3. illustrate Parallel Computing Paradigms.
4. analyze the performance issues in Parallel Programming using MPI.
5. summarize shared memory parallel programming with OpenMp.
6. support efficient MPI programming.

Module 1: Modern Processors

Stored Program Computer Architecture - General purpose cache - based microprocessor - Performance based metrics and benchmarks - Moore's Law - Pipelining- Super scalarity - SIMD - Memory Hierarchies Cache - mapping - prefetch - Multicore processors - Multithreaded processors - Vector Processors - Design Principles - Maximum performance estimates - Programming for vector architecture.

Module 2: Basic optimization techniques for serial code

Scalar profiling - function and line based runtime profiling - hardware performance counters - common sense optimizations - simple measures, large impact - elimination of common subexpressions - avoiding branches - using simd instruction sets - the role of compilers - general optimization options - inlining - aliasing- computational accuracy- register optimizations - using compiler logs- c++ optimizations - temporaries - dynamic memory management - loop kernels and iterators data access optimization: balance analysis and light speed estimates- storage order- case study: jacobi algorithm and dense matrix transpose.

Module 3: Parallel Computers

Taxonomy of parallel computing paradigms- Shared memory computers - Cache coherance - UMA - ccNUMA- Distributed-memory computers- Hierarchical systems - Networks - Basic performance characteristics- Buses- Switched and fat- tree networks - Mesh networks - Hybrids - Basics of parallelization - Need of parallelize - Data Parallelism - Function Parallelism - Parallel Scalability - Factors that limit parallel execution - Scalability metrics - Simple scalability laws- parallel efficiency - serial performance Vs Strong scalability- Refined performance models - Choosing the right scaling baseline - Case Study: Can slow processors compute faster- Load balance.

Module 4: Distributed memory parallel programming with MPI

Message passing - Introduction to MPI – example - messages and point-to-point communication - collective communication – nonblocking point-to-point communication - virtual topologies - MPI parallelization of Jacobi solver- MPI implementation - performance properties

Module 5: Shared memory parallel programming with OpenMp

Introduction to OpenMp - parallel execution - data scoping - OpenMp work sharing for loops - synchronization - reductions - loop scheduling - tasking - case study: OpenMp - parallel jacobi algorithm - advanced OpenMp wavefront parallelization - Efficient OpenMP programming: Profiling OpenMP programs - Performance pitfalls - Case study : Parallel Sparse matrix-vector multiply.

Module 6: Efficient MPI programming

MPI performance tools - communication parameters - Synchronization, serialization, contention - Reducing communication overhead- optimal domain decomposition - Aggregating messages – Nonblocking Vs Asynchronous communication - Collective communication- Understanding intra-node point-to-point communication.

Reference Books:

1. Georg Hager, Gerhard Wellein, Introduction to High Performance Computing for Scientists and Engineers, Chapman & Hall / CRC Computational Science series, First Edition, CRC Press, 2010, ISBN-13: 978-1439811924.
2. Thomas Sterling Matthew Anderson Maciej Brodowicz, High Performance Computing - Modern Systems and Practices, First Edition, Morgan Kaufmann Publishers, 2017, ISBN-13: 9780124201583.
3. Charles Severance, Kevin Dowd, High Performance Computing (RISC Architectures, Optimization & Benchmarks), Second Edition, O'Reilly Media, 1998, ISBN-13: 978-1565923126.

18CS3045	High Performance Scientific Computing	L	T	P	C
		3	0	0	3

Course Objective:

Enable the student to

1. provide insight to high performance computation techniques
2. understand parallel and heterogeneous computation languages
3. describe high performance computing with an orientation towards applications in science and engineering.

Course Outcomes

The student will be able to

1. relate parallel and shared memory architecture
2. choose parallel computation languages which includes MPI and OpenMP.
3. appreciate the building blocks of scientific and engineering software.
4. demonstrate a basic knowledge of numerical computing using an appropriate programming language.
5. reason about the accuracy of mathematical and numerical models of real physical phenomena.
6. write algorithms that yield good performance on high-performance architectures.

Module 1:

Overview of parallel system organization

Module 2:

Introduction to message passing and MPI programming

Module 3:

Embarrassingly parallel problems; Problem decomposition, graph partitioning,
and load balancing

Module 4:

Introduction to shared memory and OpenMP programming;

Module 5:

Examples of scientific computing, Parallel Languages.

Module 6:

Case study of Problem decomposition, graph partitioning, and load balancing using OpenMP.

Reference Books:

1. Thomas Rauber and Gudula Runger, “Parallel Programming for Multicore and Cluster Systems”,2010, Springer.
2. Scott, Clark, and Bagheri, “Scientific Parallel Computing”, 2005,
3. Chapman, Jost, and van der Pas, “Using OpenMP: Portable Shared Memory Parallel Programming”

18CS3046	High Speed Networks	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand network architectures, protocols, control, performance, and economies.
2. explore the mathematics behind Circuit Switched Networks, Datagram networks and Asynchronous Transfer Mode Networks.
3. insight on the convergence of the telephone, computer networking, cable TV, and wireless networks that explains current and emerging networking technologies.

Course Outcomes:

The student will be able to

1. describe packet switched networks, circuit switched networks, Internet and TCP / IP networks.
2. translate packet switched networks, circuit switched networks, Internet and TCP / IP networks to wireless networks.
3. use the ATM and optical network.
4. analyze the various switching techniques.
5. evaluate wireless network and the mathematical background.
6. incorporate network security and management.

Module 1: Packet switched Networks and Internet and TCP/IP Networks

OSI and IP models - The Internet -Overview of Internet Protocols - Internet Protocol - TCP and UDP, Internet Success and Limitation - Performance of TCP/IP Network - Circuit Switched Networks: Performance of Circuit Switched Networks.

Module 2: SONET and ATM

SONET - Dense Wave Division Multiplexing (DWDM), Fiber to the Home - Digital Subscriber Line (DSL) - Intelligent Networks - ATM - Main Features of ATM - Addressing Signaling and Routing - Header Structure - ATM Adaptation layer - Management and Control - BISDN & Internetworking with ATM.

Module 3: Wireless Networks and Control of Networks

Link level design - Channel access - Network design - Wireless Networks Today - Future Systems and standards - Control of Networks - Objectives and methods of control - Circuit Switched Networks - Datagram networks, ATM Networks.

Module 4: Mathematical Background

Markov Chains, Circuit Switched Networks - Datagram networks - ATM Networks - Optical Networks: Optical Links - WDM Systems & Optical Cross Connects - Optical LANs - Optical paths and Networks.

Module 5: Switching

Switch Performance Measures, Time and Space Division Switching - Modular Switch Designs - Packet Switching - Distributed Buffer - Shared Buffer - Output Buffer, Input Buffer - Global Multimedia Network: Attributes of the Global - Network Technology areas Challenges.

Module 6: Network Security and Management

Principles of cryptography – Elliptic-AES- Authentication – Integrity – key distribution and certification – Access control- Fire walls – DoS-attacks and counter measures – Security in OSI layers. Infrastructure for network management – The internet standard management framework – SMI, MIB, SNMP, Security and administration – ASN.1.

Reference Books:

1. Walrand. J. Varaiya, "High Performance Communication Network", Morgan Kaufmann-Harcourt Asia Pvt., Ltd., 2nd Edition, 2000, ISBN-10: 15-5860-574-6.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks: A System Approach", Morgan Kaufmann, 3rd Edition, 2003, ISBN: 1-55860-833-8.
3. J.F.Kurose and K.W. Ross, "Computer Networking-A top-down approach featuring the internet", Addison Wesley, 6th Edition, 2012, ISBN-13: 978-0132856201.

4. William Stallings, "ISDN and Broadband ISDN with frame Relay and ATM", Pearson Education, 4th Edition, 2009, ISBN-13: 978-0139737442.
5. Rainer Handel, Manfred N. Huber, Steffen Schroeder, "ATM Networks, Concepts, Protocols Applications", Pearson Education, 3rd Edition, 2009, ISBN-10: 8177585290.
6. Behrouz A. Forouzan, "TCP/IP Protocol Suite", Tata McGraw Hill, Fourth Edition, 2009. ISBN-13: 978-0073376042.

18CS3047	HPC Architecture and Ecosystem	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the advanced concepts of computer architecture.
2. analyze modern design structures of pipelined and multiprocessors systems.
3. appraise recent computer architectures and I/O devices.

Course Outcomes:

The student will be able to

1. describe the contemporary computer architecture issues and techniques.
2. discuss performance of different instruction set architectures and memory addressing.
3. apply concepts of high-performance computer architecture and pipelining logic.
4. distinguish various multiprocessing configurations.
5. design the overall organization of parallel computer models and advanced processors.
6. develop applications for high performance computing systems.

Module 1: Fundamentals of Computer Design

Introduction - The changing face of computing and the task of the computer designer -Technology Trends - Cost- Price and their trends - Measuring and Reporting performance -Quantitative Principles of computer design -Performance and Price-:

Module 2: Instruction set and Memory Addressing

Introduction -Classifying Instruction set Architectures- Memory Addressing -Addressing Modes for signal processing -Type and size of operands -Operands for media and signal processing -operations in the instruction set - Instruction for control flow - Encoding an instruction set.

Module 3: Pipelining

Introduction - The Major Hurdle of pipelining - pipeline Hazards - Implementation - Extending the MIPS pipeline to handle multi cycle operations Instruction -Level parallelism: concepts and challenges - overcoming data Hazards with Dynamic scheduling - Reducing Branch costs with Dynamic Hardware Prediction - High Performance instruction delivery -Taking advantage of More ILP with Multiple Issue - Hardware - Based speculation - Studies of the Limitations of ILP.

Module 4: Exploiting Instruction

Level Parallelism with Software Approaches- Basic compiler Techniques for Exposing ILP - Static Branch Prediction - Static Multiple issue: The VLIW approach - advanced compiler support for Exposing and Exploiting ILP -Hardware support for Exposing more parallelism at compile Time - crosscutting issues: Hardware versus software speculation mechanisms.

Module 5: Multiprocessors and Thread

Level Parallelism: Introduction - Characteristics of Application domains - symmetric shared - memory architectures - performance of symmetric shared - memory multiprocessors Distributed shared - memory architectures - performance of distributed shared - memory multiprocessors - synchronization - models of memory consistency: Introduction.

Module 6: Multithreading

Exploiting Thread - Level parallelism within a processor- Memory Hierarchy Design: Introduction - Review of the ABCs of the caches- Cache Performance - Reducing Cache Miss Penalty - Reducing Miss Rate - Reducing Cache Miss Penalty or Miss Rate via Parallelism - Reducing Hit Time - Main Memory

and Organizations for Improving Performance - Memory Technology -Virtual Memory - Protection and Examples of Virtual Memory

Reference Books:

1. John L. Hennessy and David Patterson, Computer Architecture, A Quantitative Approach, Fourth Edition, Elsevier, 2012. ISBN-13:012383872X
2. Kai Hwang, Advanced Computer Architecture, Parallelism, Scalability, Programmability, McGraw-Hill, ISBN: 0070316228, Eighteenth Reprint-2008
3. Barry Wilkinson and Michael Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2nd Edition, Prentice Hall, 2005. ISBN: 0-13-140563-2.
4. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGraw -Hill, New York, 2012, ISBN: 9781259029141,
5. H.S.Stone, High Performance Computer Architecture, Addison Wesley, Reading Mass, 2009, Reprint Edition ISBN: 9780201168020.
6. W. Stallings, Computer Organization and Architecture, Ninth Edition, 2012, ISBN 9780132936330.

18CS3048	Human Centered Computing	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. introduce theoretical aspects of human centered computing,
2. review a subset of current applications and open problems.
3. understand how interactive computing systems for humans are designed

Course Outcomes:

The student will be able to

1. appraise the important aspects of human-centered systems
2. understand humans and model their preferences, interests, and knowledge;
3. comprehend wide range of theories, and their application to the design of interactive computing systems
4. analyse explicitly and implicitly generated data
5. design systems with natural and intuitive interfaces.
6. develop a range of human centered information systems

Module 1: Prelims

Intro, logistics, overview, Introduction to small data, Different flavors of mathematical/computational models, Model fitting, evaluation metrics, Parameter estimation, model selection and non-parametric methods.

Module 2: Search

Classical search/information retrieval, Query completion, Contextual/topical search foci, Information scent and other foraging models, Temporal information retrieval, Serendipity, discovery.

Module 3: Preferences

Recommender systems, Collaborative filtering, Feature selection, SVD, Different flavors of recommender systems, Validation, measurement metrics, Diversity.

Module 4: Emotions

Theories and schema, Sentiment analysis, Affect measurement (computer vision, survey instruments, activity monitoring), Chatbots to emotebots, Brain-computer interface, Boredom/ennui.

Module 5: Goals

Basic goal-directed agents, Hebbian/reinforcement learning, Explore-exploit dilemma, Curiosity, perseverance, intrinsic motivation as goals, Gamification, Deep principles – flow, connectedness, homeostasis, etc.

Module 6: Case Study
Recent trends and applications of Human Centered Computing. Case study of classical search and information retrieval techniques.

Reference Books:

1. Croft, Metzler, Strohman, "Search engines: Information Retrieval in practice", Pearson Education, 2011, ISBN-13: 978-0136072249.
2. Pang, B., & Lee, L., "Opinion mining and sentiment analysis. Foundations and trends in information retrieval", now publishers, 2008, ISSN.1554-0669.
3. Picard, R. W., & Picard, R., "Affective computing", Cambridge: MIT press, 2000, ISBN: 9780262661157.
4. Shapira, B., Ricci, F., Kantor, P. B., & Rokach, L., "Recommender Systems Handbook", 2011, Springer Press. ISBN 978-0-387-85820-3
5. Wiering, M., van Otterlo, Martijn, "Reinforcement learning", 2012, Springer Press, ISBN 978-3-642-27644-6.

18CS3049	Human Computer Interaction	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the students to
1. learn the foundations of Human Computer Interaction
2. familiar with the design technologies for individuals and persons with disabilities
3. aware of mobile Human Computer interaction.

Course Outcomes
The student will be able to:
1. understand the structure of models and theories of human computer interaction and vision.
2. understand the usability engineering models
3. understand the cognitive models in user interface
4. apply the user interface for mobile ecosystem
5. design an interactive web interface on the basis of models studied.
6. Apply speech recognition and multimodal system

Module 1: Human: I/O channels – Memory – Reasoning and problem solving; The computer: Devices – Memory – processing and networks; Interaction: Models – frameworks – Ergonomics – styles – elements – interactivity- Paradigms.

Module 2: Interactive Design basics – process – scenarios – navigation – screen design – Iteration and prototyping. HCI in software process – software life cycle – usability engineering – Prototyping in practice – design rationale. Design rules – principles, standards, guidelines, rules. Evaluation Techniques – Universal Design.

Module 3: Cognitive models –Socio-Organizational issues and stake holder requirements – Communication and collaboration models-Hypertext, Multimedia and WWW.

Module 4: Mobile Ecosystem: Platforms, Application frameworks- Types of Mobile Applications: Widgets, Applications, Games- Mobile Information Architecture, Mobile 2.0, Mobile Design: Elements of Mobile Design, Tools.

Module 5:
Designing Web Interfaces – Drag & Drop, Direct Selection, Contextual Tools, Overlays, Inlays and Virtual Pages, Process Flow. Case Studies.

Module 6:
Recent Trends: Speech Recognition and Translation, Multimodal System

Reference Books:

1. Alan Dix, Janet Finlay, Gregory Abowd, Russell Beale, "Human Computer Interaction", 3rd Edition, Pearson Education, 2004

2. Brian Fling, “Mobile Design and Development”, First Edition , O□Reilly Media Inc., 2009
3. Bill Scott and Theresa Neil, “Designing Web Interfaces”, First Edition, O’Reilly, 2009.

18CS3050	Information Theory and Coding	L 3	T 0	P 0	C 3

Course Objectives:

Enable the student to

1. practice information theory
2. provide an insight to information coding techniques, error detection and correction mechanisms, various compression techniques and cryptography fundamentals
3. provide hands-on on compression techniques

Course Outcomes:

The student will be able to

1. evaluate how information is measured in terms of entropy and apply various channel capacity
2. apply different error detecting and correcting codes
3. evaluate performance of various coding techniques
4. analyze compression techniques for text, image and video
5. apply the information coding and compression techniques
6. appraise different compression techniques

Module 1: Fundamental Limits in Information Theory

Information and entropy information measures, Shannon’s concept of Information. Channel coding, channel mutual information capacity (BW)

Module 2: Channel capacity and coding

Theorem for discrete memory less channel, information capacity theorem, Error detecting and error correcting codes

Module 3: Linear Block and Cyclic codes

Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques,

Module 4: Compression Techniques

Compression: loss less and lossy, Huffman codes, LZW algorithm, Binary Image compression schemes, run length encoding, CCITT group 3 1- DCompression, CCITT group 3 2D compression, CCITT group 4 2DCompression, JPEG

Module 5: Encoding and Decoding

Convolutional codes, sequential decoding. Video image Compression: CITT H.264 Video coding algorithm, audio (speech) Compression. Cryptography and cipher

Module 6: Case Studies

Case study of CCITT group 3 1-DCompression, CCITT group 3 2D compression.

Reference Books:

1. Borda, Monica, Fundamentals in information theory and coding, Springer, 2011 ISBN 978-3-642-20346-6
2. Singh and Sapre, Communication Systems: Analog and digital, TataMcGraw Hill, 2008 2nd ed., ISBN 978-0-07-063454-1
3. Fred Halsall, Multimedia Communications: Applications, Networks, Protocols and Standards, Pearson Education, Asia, Second Indian reprint 2002.
4. R Bose, Information Theory, Coding and Cryptography, 2008, 2nd edition, ISBN: 9780070669017
5. Prabhat K.Andleigh and Kiran Thakrar, Multimedia Systems Design, 2015, Pearson Education India, ISBN - 10 : 9332549389

18CS3051	Intelligent Systems	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. introduce the basic concepts of artificial intelligence.
2. introduce new approaches to solve a wide variety of research-oriented problem.
3. learn about the expert systems.

Course Outcomes:

The student will be able to

1. match natural language into first order logic and vice versa.
2. express knowledge representation techniques and problem solving strategies to common AI applications.
3. prepare appropriate knowledge based rules to identify causal relationships and conditional independence of a real-world situation.
4. select the appropriate search method for identifying different search spaces.
5. design working knowledge of reasoning in the presence of incomplete and/or uncertain information.
6. interpret the learning theory for expert systems

Module 1: Introduction to AI and Production Systems

Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics -Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction

Module 2: Representation of Knowledge

Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.

Module 3: Knowledge Inference

Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory.

Module 4: Planning and Machine Learning

Basic plan generation systems - Strips -Advanced plan generation systems – K strips - Strategic explanations - Learning- Machine learning, adaptive Learning.- Neural net learning and genetic learning

Module 5: Expert Systems

Expert systems - Architecture of expert systems, Roles of expert systems - Knowledge Acquisition – Meta knowledge, Heuristics. Typical expert systems - MYCIN, DART, XOON, Expert systems shells.

Module 6: Recent Trends

Recent trends in Fuzzy logic, A study of different learning and evolutionary algorithms, such as statistical learning and induction learning.

Reference Books:

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, Third Edition, McGraw-Hill, 2009. ISBN -13: 973-0-07-008770-5. ISBN-10:0-07-008770-9.
2. Dan W. Patterson, “Introduction to AI and ES”, Pearson Education, 2007.
3. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition, Prentice Hall, 2010.
4. Nils J. Nilsson, “Artificial Intelligence: A new Synthesis”, Elsevier-Morgan Kaufmann, 2011.
5. Dan W.Patterson, “Introduction to Artificial Intelligence and Expert Systems”, Prentice Hall India, 2010.

6. David Poole and Alan Mackworth," Artificial Intelligence: foundations of computational agents", Cambridge University Press, 2010.
7. Al-Dahoud Ali ,"Computational Intelligence and Modern Heuristics" , InTech , 2010

18CS3052	Internet of Things	L 3	T 0	P 0	C 3

Course Objectives:

Enable the student to

1. learn Internet of Things principles and prototyping concepts.
2. design internet of Things products.
3. familiarize with Internet of Things applications.

Course Outcomes

The student will be able to

1. describe the working principles of internet of things.
2. convert the principles into to a working prototype.
3. interpret the prototype into real life working models.
4. illustrate IOT business models.
5. design IOT based smart applications.
6. relate IOT applications to solve problems of humanity

Module 1: Overview of Internet of things and Design and Internet principles

An Overview The Technology of Internet of Things - Design Principles for Connected Devices - Internet Communications Overview - IP Address - MAC Addresses - TCP and UDP Ports - application Layer Protocols

Module 2: Prototyping Principles

Sketching - Familiarity - Cost versus Ease of Prototyping - Prototypes and Production - Open source versus closed source

Module 3: Prototyping Hardware

Electronics-Embedded Computing Basics- Arduino- Rasberry Pi- BeagleBone Black - Electric Imp - Other Notable Platforms

Module 4: Prototyping Physical Design

Preparation-Sketch, Iterate and Explore - Nondigital Methods-Laser Cutting- 3D Printing- CNC Milling _ Repurposing- Getting started with an API- Writing a New API- Real - Time Reactions

Module 5: Prototyping to Reality

Business Models History - The Business model canvas - Models - Funding an Internet of Things Startup - Moving to Manufacture - Designing Kits - Printed circuit boards - Scaling up Software - Ethics

Module 6: IOT Applications

Smart monitoring and Diagnostics Systems at Major Power Plants - Smart Factory - Intelligent Lot Tracking - Cleaning services Industry and Technology - Global coin chain Management - LHCb Experiment at CERN - Connected Vehicles - Smart city

Reference Books:

1. McEwen, Adrian, and Hakim Cassimally. "Designing the internet of things". John Wiley & Sons, 2013.
2. Slama, Dirk, et al. "Enterprise IoT: Strategies and Best Practices for Connected Products and Services", O'Reilly Media, Inc., 2015.
3. Bahga, Arshdeep, and Vijay Madisetti. "Internet of Things: A Hands-on Approach," VPT, 2014.
4. Greengard, Samuel. "The Internet of things. MIT Press," 2015.

18CS3053	Internet of Things Security	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the Security requirements in IoT.
2. infer the cryptographic fundamentals for IoT
3. apply the authentication credentials in Cloud Security.

Course Outcomes:

The student will be able to:

1. demonstrate knowledge and understanding of the security and ethical issues of the internet of things
2. conceptually identify vulnerabilities, including recent attacks, involving the internet of things
3. describe countermeasures for internet of things devices and security threats.
4. analyze the societal impact of IOT security events
5. develop critical thinking skills

Module 1: Introduction to IOT

An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations. M2M and IoT Technology Fundamentals- Devices and gateways, Local and wide area networking, Data management, Business processes in IoT, Everything as a Service (XaaS), M2M and IoT Analytics, Knowledge Management.

Module 2: Securing the Internet of Things

Security Requirements in IoT Architecture - Security in Enabling Technologies - Security Concerns in IoT Applications. Security Architecture in the Internet of Things - Security Requirements in IoT - Insufficient Authentication/Authorization.

Module 3: Insecure Access Control

Threats to Access Control, Privacy, and Availability - Attacks Specific to IoT. Vulnerabilities – Secrecy and Secret-Key Capacity - Authentication/Authorization for Smart Devices - Transport Encryption – Attack & Fault trees

Module 4- Cryptographic Fundamentals for IOT

Cryptographic primitives and its role in IoT – Encryption and Decryption – Hashes – Digital Signatures – Random number generation – Cipher suites – key management fundamentals – cryptographic controls built into IoT messaging and communication protocols – IoT Node Authentication

Module 5: Dentity and Access Management Solutions for IOT

Identity lifecycle – authentication credentials – IoT IAM infrastructure – Authorization with Publish / Subscribe schemes – access control - privacy preservation and trust models for iot -Concerns in data dissemination – Lightweight and robust schemes for Privacy protection – Trust and Trust models for IoT – self-organizing Things - Preventing unauthorized access.

Module 6: Cloud Security IOT

Cloud services and IoT – offerings related to IoT from cloud service providers – Cloud IoT security controls – An enterprise IoT cloud security architecture – New directions in cloud enabled IoT computing

Reference Books:

1. Vijay Madisetti and Arshdeep Bahga, "Internet of Things (A Hands-on Approach)", 1st Edition, VPT, 2014.
2. Jan Holler, Vlasios Tsiatsis, Catherine Mulligan, Stefan Avesand, Tamatis Karnouskos, David Boyle, "From Machine-to-Machine to the Internet of Things: Introduction to a New Age of Intelligence", 1st Edition, Academic Press, 2014
3. Brian Russell, Drew Van Duren, Practical Internet of Things Security, Packt Publishing, 2016

18CS3054	Internetworking with TCP/IP	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the layers of TCP/IP and how all protocols in the TCP/IP suite fit into the five-layer model.
2. identify the possibilities of interconnecting multiple physical networks into a coordinated system.
3. summarize the details of the global TCP/IP internet including the architecture of its router system and the application protocols it supports.

Course Outcomes:

The student will be able to

1. identify the various TCP/IP protocols used for the networking application.
2. distinguish the use of interior and exterior routing protocols used for different networks.
3. demonstrate the working of various protocols in internetworks.
4. analyze the behaviour of internetworking different networks in MPLS networks.
5. relate the switching and forwarding operations of internetworks.
6. summarize the applications of various protocols used in internetworks.

Module 1: Introduction to TCP/IP

Layering - Link Layer - IP Internet Addresses - IP Internet Protocols- IP Header - IP Routing - Subnet Addressing - Subnet Mask - Special Case IP Address - A Subnet Example - ifconfig Command - netstat Command - IP Futures.

Module 2: Link Layer

Address Resolution Protocol- ARP Cache - ARP Packet Format - ARP Examples - Proxy ARP - Gratuitous ARP - arp Command- Reverse Address Resolution Protocol - RARP Packet Format - RARP Examples - RARP Server design – Internet Control Message Protocol ICMP Message Types - ICMP Address Mask Request and Reply - ICMP Timestamp Request and Reply - ICMP Port Unreachable Error - 4.4BSD Processing of ICMP Messages.

Module 3: IP Routing

Routing Principles - ICMP Host and Network Unreachable Errors - To Forward or Not to Forward - ICMP Redirect Errors - ICMP Router Discovery Messages - Dynamic Routing Protocols - Unix Routing Daemons - RIP: Routing Information Protocol - RIP Version 2 - OSPF: Open Shortest Path First - BGP: Border Gateway Protocol - CIDR: Classless Interdomain Routing - User Datagram Protocol - UDP Header - UDP Checksum - A Simple Example - IP Fragmentation - ICMP Unreachable Error (Fragmentation Required) - Determining the Path MTU Using Traceroute - Path MTU Discovery with UDP - Interaction Between UDP and ARP - Maximum UDP Datagram Size - ICMP Source Quench Error - UDP Server Design.

Module 4: Broadcasting and Multicasting

Broadcasting - Broadcasting Examples - Multicasting - IGMP Message - IGMP Protocol - An Example - IGMP - DNS - DNS Basics - DNS Message Format- A Simple Example - Pointer Queries - Resourse Records - Caching - UDP or TCP - TFTP Protocol - An Example.

Module 5: Security

BOOTP - BOOTP Packet Format - BOOTP Server Design - BOOTP Through a Router - Vendor-Specific Information - TCP Protocol - TCP Services - TCP Header - SNMP Protocol - Protocol - Structure of Management Information - Object Identifiers - Introduction to the Management Information Base - Instance Identification - Simple Examples- Management Information Base - Telnet and Rlogin - FTP Protocol - SMTP Protocol - NFS Protocol.

Module 6: MPLS Switching

Introduction - Label Switching Basics - Switching and Forwarding Operations - MPLS Key Concepts - Label Distribution Operations - MPLS and ATM and Frame Relay Networks - Traffic Engineering-OSPF in MPLS Networks.

Reference Books:

1. W. Richard Stevens, TCP/IP Illustrated Volume - I, The Protocols, Second Edition, Addison-Wesley, 2011. ISBN: 978-0321336316.
2. Uyless Black, MPLS and Label Switching Networks, Pearson Education, Second Edition, 2002. ISBN: 81-7808-650-6.
3. Behrouz A. Forouzan, TCP/IP Protocol Suite, Tata McGraw Hill, Fourth Edition, 2009. ISBN: 978-0073376042
4. Douglas E. Comer, Internetworking with TCP/IP - Principles, Protocols and Architecture, Pearson Education, Fifth Edition, 2007. ISBN: 978-81-203-2998-0.

18CS3055	IoT and Smart Cities	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the requirements for building the smart city
2. compare and analyze the various technologies and devices for smart cities
3. manage and plan the requirements for the construction of smart cities

Course Outcomes:

The student will be able to

1. identify the necessity for smart cities
2. describe the factors influencing the smart cities
3. apply the IoT technologies in healthcare and security areas
4. analyze data in smart buildings, including data stemming from sensors and IoT devices
5. evaluate the devices and technologies deeded for smart cities
6. design and plan the architecture for smart cities

Module 1: Envisioning Intelligent Cities

The Need for Intelligent Cities, City-Specific Challenges, The Vast Potentials of Smart Cities, City Transformation Strategy, The Key Trends in IT toward Smart Cities, Smart City Infrastructure and Platform Solutions, The Context-Aware Framework for Smart City Applications

Module 2: Mobile Technologies and Applications for Intelligent Cities

Evolution of Mobile Wireless Technologies, Mobile Application Development Platforms, Challenges of Intelligent Cities and Solutions Offered by Mobile Wireless Networks and Devices, Enabling Mobile Technologies for an Intelligent City

Module 3: Internet of Things for Connected and Cognitive Cities

Envisioning the IoT Era, Emerging IoT Trends, The IoT Reference Architecture, Prominent IoT Technologies, The IoT: The Key Results, Advantages of the IoT Concept for Smart Cities, Popular IoT/M2M Applications, Cyber Physical System for Smart City Needs, Smart City Platforms and Frameworks, Homeland Security and the Sensor Cloud

Module 4: Smart Homes and Buildings

Elucidating Technological Advancements, Key Drivers for Smarter Homes and Buildings, Smarter Homes and Building Elements, Envisioning Smarter Homes and Buildings: The Role of the Cloud Theme, Smarter Home/Building Capabilities, Smarter Home/Building Services in Clouds, IP-Based Convergence of Building Systems, smarter Homes: Architectural Styles, Patterns, and Approaches, Home Integration Standards: Industry Strength and Proprietary

Module 5: Internet-of-Things Analytics for Smart Cities

Cloud-based IoT Analytics, Cloud-based City Platform, New Challenges towards Edge-based Solutions, Edge-based IoT Analytics, Use Case of Edge-based Data Analytics

Module 6: Healthcare & Security

Cloud Services in the Healthcare Sector, Electronic Storage of Medical Records, Office Productivity Solutions, Health Information Exchange, Collaboration Solution for Physicians, Support for Providers, Security Requirements of an Intelligent City, Threat Monitoring and Intelligence, Security Threats, solutions and concerns in Internet of Things Platform, Security Measures for IoT Platforms/Devices,

Security Threats to Different IT-Based Infrastructure Components of an Intelligent City, Best Practices to Be Adopted for a Secure Intelligent City

Reference Books:

1. Pethuru Raj Anupama C. Raman, Intelligent Cities - Enabling Tools and Technology, CRC Press Taylor & Francis Group, 2015, ISBN: 978-1-4822-9998-4
2. John Soldatos, Building Blocks for IoT Analytics Internet-of-Things Analytics, River Publishers, 2017, ISBN: 978-87-93519-03-9
3. Mohammad Obaidat and Petros Nicopolitidis, Smart Cities and Homes - Key Enabling Technologies, Elsevier, 2016, ISBN: 9780128034545
4. Dustdar, Schahram, Nastić, Stefan, Šćekić, Ognjen, Smart Cities - The Internet of Things, People and Systems, Springer, 2017, ISBN 978-3-319-60030-7
5. Houbing Song, Ravi Srinivasan, Tamim Sookoor, Sabina Jeschke, Smart Cities: Foundations, Principles, and Applications, Wiley, 2017, ISBN: 978-1-119-22639-0

18CS3056	IoT Application and Communication Protocol	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the students to

1. learn all the elements of IoT, mechanical, electronics/sensor platform for IoT, wireless and wireline protocols of IoT.
2. familiarize open source/commercial electronics platform for IoT-Raspberry Pi, Arduino.
3. practice open source /commercial enterprise cloud platform for IoT-Ayla, Libellium, Axeda, Cisco fog cloud.

Course Outcomes:

The student will be able to

1. understand the architecture and various components of IoT
2. describe the working principles of IoT protocols.
3. determine the Market perspective of IoT.
4. recognize merging technological options, platforms and case studies of IoT implementation in home & city automation.
5. relate IoT applications to solve problems of humanity
6. design IoT based smart applications.

Module 1: Architecture of a sensor

Basic function and architecture of a sensor - Sensor body, sensor mechanism, sensor calibration, sensor maintenance, cost and pricing structure, legacy and modern sensor network. Development of sensor electronics - IoT vs legacy, and open source vs traditional PCB design style - Development of sensor communication protocol - Protocols: Modbus, relay, Zigbee, Zwave, X10, Bluetooth, ANT, etc. - Business driver for sensor deployment - FDA/EPA regulation, fraud/tempering detection, supervision, quality control and process management - Powering options for sensors: Battery, Solar, Witricity, Mobile and PoE.

Module 2: IoT Protocols

Zigbee and Zwave - Advantage of low power mesh networking - Long distance Zigbee - Introduction to different Zigbee chips - Bluetooth/BLE: Low power vs high power, speed of detection, class of BLE - Introduction of Bluetooth vendors & their review - Wireless protocols such as Piconet and packet structure for BLE and Zigbee.

Module 3: IoT Components

PCB vs FPGA vs ASIC design - Prototyping electronics vs Production electronics - QA certificate for IoT - CE/CSA/UL/IEC/RoHS/IP65 - Basic introduction of multi-layer PCB design and its workflow - Basic Open source platforms: Arduino, Raspberry Pi, Beaglebone.

Module 4: Mobile app platform for IoT
Introduction to Mobile app platform for IoT: Protocol stack of Mobile app for IoT - Mobile to server integration - iBeacon in IoS - Window Azure - Linkafy Mobile platform for IoT.
Module 5: Database implementation for IoT
Cloud based IoT platforms - SQL vs NoSQL - Open sourced vs. Licensed Database - Available M2M cloud platform – AxedaXively - Omega NovoTech - Ayla Libellium - CISCO M2M platform - AT &T M2M platform - Google M2M platform.
Module 6: IoT Home Automation
Recent trends in home automation - IOT-locks - Energy optimization in home.

Reference Books:

1. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things: Key Applications and Protocols", Wiley-Blackwell, 2012.
2. McEwen, Adrian, and Hakim Cassimally. "Designing the internet of things", John Wiley & Sons, 2013.
3. Slama, Dirk, et al. "Enterprise IoT: Strategies and Best Practices for Connected Products and Services", O'Reilly Media, Inc., 2015.
4. Bahga, Arshdeep, and Vijay Madisetti. "Internet of Things: A Hands-on Approach", VPT, 2014.
5. Greengard, Samuel. "The Internet of things", MIT Press, 2015.
6. A Hamad Omar, "Proposed Routing Protocol for Internet of Things", Lambert Academic Publishing, 2014.

18CS3057	Knowledge Discovery	L	T	P	C
		3	0	0	3

Course Objective
Enable the student to
1. Learn knowledge discovery in database
2. infer knowledge of various knowledge representation methods.
3. conduct case studies on real data mining examples

Course Outcome:
The student will be able to
1. understand knowledge of various knowledge representation methods.
2. understand KDD and data mining
3. apply decision tree method to predict learning results
4. apply classification rules for making decision
5. evaluate numeric predictions
6. understand artificial neural networks concepts for discovering knowledge

Module 1: Introduction KDD and Data Mining
Data Mining and Machine Learning, Machine Learning and Statistics, Generalization as Search, Data Mining and Ethics
Module 2: Knowledge Representation
Decision Tables, Decision Trees, Classification Rules, Association Rules, Rules involving Relations, Trees for Numeric Predictions, Neural Networks, Clusters
Module 3: Decision Trees
Divide and Conquer, Calculating Information, Entropy, Pruning, Estimating Error Rates, The C4.5 Algorithm Evaluation of Learned Results- Training and Testing, Predicting Performance, Cross-Validation
Module 4: Classification Rules
Inferring Rudimentary Rules, Covering Algorithms for Rule Construction, Probability Measure for Rule Evaluation, Association Rules, Item Sets, Rule Efficiency

Module 5: Numeric Predictions
Linear Models for Classification and Numeric Predictions, Numeric Predictions with Regression Trees, Evaluating Numeric Predictions.
Module 6: Artificial Neural Networks
Perceptrons, Multilayer Networks, The Backpropagation Algorithm Clustering - Iterative Distance-based Clustering, Incremental Clustering, The EM Algorithm

Reference Books:

1. Maimon, Oded, Rokach, Lior (Eds.), "Data mining and knowledge discovery handbook", 2010, Springer
2. Jonathan I. Maletic, Andrian Marcus, "Data Cleansing : A Prelude to knowledge Discovery", 2010, Springer

18CS3058	Logic and Functional Programming	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. state of the art on the theoretical and practical aspects of developing declarative programming tools in logic programming.
2. describe basics of functional programming and constraint logic programming
3. apply formal concepts used as a theoretical basis for both paradigms, basic knowledge and practical experience.

Course Outcomes:
The student will be able to
1. define the basics of proposition logic
2. understand in depth the use of natural deduction and axiomatic propositional logic.
3. understand the use of predicate logic.
4. solve problems using predictive logic.
5. use lazy and eager evaluation strategies in problem solving.
6. solve problems using functional and logic programming.

Module 1: Proposition Logic
Introduction of logic and Functional Paradigm, Propositional Concepts, Semantic Table, Problem Solving with Semantic Table.
Module 2: Natural Deduction and Axiomatic Propositional Logic
Rules of Natural Deduction, Sequent Calculus, Axiomatic Systems, Meta theorems, Important Properties of AL, Resolution, Resolving Arguments
Module 3: Introduction to Predicate Logic
Objects, Predicates and Quantifiers, Functions, First Order Language, Quantifiers, Scope and Binding, Substitution, An Axiomatic System for First Order Predicate Logic, Soundness and Completeness, Axiomatic Semantic and Programming
Module 4: Semantic Tableaux & Resolution in Predicate Logic
Semantic Tableaux, Instantiation Rules, Problem-solving in Predicate Logic, Normal forms, Herbrand Universes and H-interpretation, Resolution, Unification, Resolution as a computing Tool, Nondeterministic Programming, Incomplete Data Structure, Second Order Programming in Prolog, Logic Grammars: Definite Clause Grammar, A Grammar Interpreter.
Module 5: Evaluation Strategies, Lazy Evaluation
Evaluation Order and strictness of function, Programming with lazy evaluation, Interactive functional program, Delay of unnecessary Computation, Infinite Data Structure, Eager Evaluation and Reasoning.
Module 6: Recent Trends
Recent trends in logical and functional programming, predicate logics and various evaluation strategies.

Reference Books:

1. Maimon, Oded, Rokach, Lior (Eds.), "Data Mining and Knowledge Discovery Handbook" 2010, Springer
2. Ian Davidson and Xingquan Zhu, "Knowledge Discovery and Data Mining: Challenges and Realities", 2007, IGI Global.
3. Saroj Kaushik, "Logic and Prolog Programming", 2008, New Age International ltd

18CS3059	Machine Learning	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the existing machine learning techniques: it's concepts, mathematical background, applicability, limitations.
2. design and analyze various machine learning based applications with a modern outlook focusing on recent advances.
3. evaluate the performance of the models developed

Course Outcomes:

The student will be able to

1. describe some concepts and methods central to machine learning such as classification, regression, clustering, bias/variance.
2. explain mathematically various machine learning approaches and paradigms.
3. compare the strengths and limitations of selected machine learning algorithms and where they can be applied in different applications.
4. design and implement suitable machine learning algorithm to a given task
5. apply some state-of-the-art development frameworks and software libraries in machine learning task realization.
6. evaluate the performance of machine learning algorithms using suitable metrics

Module 1: Introduction

Learning – Types of Machine Learning – Supervised Learning – The Brain and the Neuron – Design a Learning System – Perspectives and Issues in Machine Learning – Concept Learning Task – Concept Learning as Search – Finding a Maximally Specific Hypothesis – Version Spaces and the Candidate Elimination Algorithm.

Module 2: Supervised Learning (Linear Models)

Basic methods: Distance-based methods, Nearest-Neighbors, Decision Trees, Naive Bayes, Linear Regression, Logistic Regression, Generalized Linear Models, Perceptron.

Module 3: **Supervised Learning (Non-Linear Models) and Ensemble Learning**

Multilayer Perceptron, Radial Basis Function, Support Vector Machines, Nonlinearity and Kernel Methods, Ensemble Learning: Boosting, Bagging, Random Forests.

Module 4: Unsupervised Learning

Unsupervised Learning, K means Algorithms, Vector Quantization, Self-Organizing Feature Map, Partitioning Methods, Hierarchical Methods, Density based Methods, Grid based Methods, Model based Clustering Methods, Clustering High-Dimensional Data.

Module 5: Dimensionality Reduction

Dimensionality Reduction: Principal Component Analysis, Linear Discriminant Analysis, Factor Analysis, Independent Component Analysis, Locally Linear Embedding, Canonical Correlation Analysis, Isomap

Module 6: Probabilistic Learning and Reinforcement Learning

Introduction to Probabilistic Learning, Gaussian Mixture Models, EM Algorithm, Nearest Neighbour Methods, Elements of Reinforcement Learning, Model based Learning, Temporal Difference Learning, Generalization.

Reference Books:

1. Ethem Alpaydin, "Introduction to Machine Learning", (Adaptive Computation and Machine Learning Series), Third Edition, MIT Press, 2014, ISBN-10: 0262028182, ISBN-13: 978-0262028189
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", Second Edition, Chapman and Hall/Crc Machine Learning and Pattern Recognition Series, 2014, SBN-10: 1466583282, ISBN-13: 978-1466583283
3. Kevin Murphy, "Machine Learning: A Probabilistic Perspective", MIT Press, 2012, ISBN-10: 0262018020, ISBN-13: 978-0262018029
4. Christopher Bishop, "Pattern Recognition and Machine Learning" (Information Science and Statistics), Springer, 2007.
5. Trevor Hastie, Robert Tibshirani, Jerome Friedman, "The Elements of Statistical Learning: Data Mining, Inference, and Prediction", Second Edition (Springer Series in Statistics), 2016, ISBN-10: 0387848576, ISBN-13: 978-0387848570
6. Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, "Learning from Data", AMLBook Publishers, 2012 ISBN 13: 978-1600490064.
7. P. Flach, "Machine Learning: The art and science of algorithms that make sense of data", Cambridge University Press, 2012, ISBN-10: 1107422221, ISBN-13: 978-1107422223

18CS3060	Malware Analysis and Reverse Engineering	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. Understand the basics concepts of compilers and program execution.
2. Recognize the behavior of different Malwares.
3. Effectively engineer and reverse engineer a Malware.

Course Outcomes

The student will be able to

1. identify the static and dynamic analysis procedures with relevant debugging methods.
2. describe the malware behavior and recognize the anti-reverse engineering techniques which prevent the identification of malware.
3. use the malware analysis tools like ClamAV, Yara, PEiD, IDA and BinDiff to identify the malware attacks.
4. analyze the self-modifying binary malwares.
5. synthesize the malware samples by using Honeypots and Sandboxes.
6. explain the various malware attacks by using the malware forensic tools.

Module 1: Introduction to Malware Analysis

Basic static analysis - Basic dynamic analysis - Malware analysis and virtual machines - Advanced static analysis: x86 assembly - IDA Pro - Recognizing C code constructs in assembly - Analyzing malicious windows programs - Advanced dynamic analysis: Debugging - OllyDbg - kernel debugging with WinDbg.

Module 2: Malware functionality and Anti-reverse engineering techniques

Malware Behaviour -Covert Malware Launching - Data Encoding - Malware - Focused Network Signatures - 64bit Malware Anti - reverse engineering: Anti-Disassembly - Anti-Debugging - Anti - Virtual Machine Techniques - Packers and Unpacking - Shell code analysis - C++ analysis

Module 3: Malware Classification

Examining Existing ClamAV Signatures - creating a Custom ClamAV Database - Converting ClamAV Signatures to YARA - Identifying Packers with YARA and PEiD - Detecting Malware Capabilities with YARA - Python: File Type Identification and Hashing - writing a Multiple - AV Scanner - Detecting Malicious PE Files -ssdeep: Finding Similar Malware - Detecting Self - Modifying Code Comparing Binaries with IDA and BinDiff

Module 4: Honeypots

Collecting Malware Samples using Dionaea and Nepenthes -Real - Time Attack Monitoring - Real-time Event Notification and Binary Sharing with XMPP - Analysing and Replaying Attacks - Passive Identification of Remote Systems – Graphing Dionaea Attack Patterns with SQLite and Gnuplot. Python: Database-Enabled Multi – AV Uploader - Accepting Nepenthes Submissions over HTTP - Accepting Dionaea Submissions over HTTP.

Module 5: Sandboxes

Sandboxes: Scanning files with VirusTotal - Jotti - NoVirusThanks - Analyzing Malware using ThreatExpert - CWSandbox - Anubis - Joebox: Writing AutoIT Scripts - Defeating Path - dependent Malware - Defeating Process - dependent DLLs - Setting an Active HTTP Proxy. Scanning for Artifacts with Sandbox Results.

Module 6: Malware Forensics

TSK: Discovering Alternate Data Streams - Detecting Hidden Files and Directories - Finding Hidden Registry Data - Bypassing Poison Ivy's Locked Files - Bypassing Conficker's File System ACL Restrictions - Scanning for Rootkits with GMER -Detecting HTML Injection - Registry Forensics - Detecting Rogue-Installed PKI Certificates - Examining Malware that Leaks Data into the Registry - Debugging Malware - De-Obfuscation

Reference Books:

1. Michael Sikorski, Andrew Honig, Practical Malware Analysis - The Hands-On Guide to Dissecting Malicious Software, 2013, ISBN-13: 978-1-59327-290-6.
2. Michael Ligh, Steven Adair, Blake Hartstein, Matthew Richard, Malware Analyst′s Cookbook and DVD: Tools and Techniques for Fighting Malicious Code, 2010, John Wiley & Sons, ISBN: 978-0-470-61303-0.
3. Randal E. Bryant, David R. O'Hallaron, Computer Systems: A Programmer's Perspective, 3rd Edition, Pearson, 2010, ISBN-13: 978-0136108047.
4. Jon Erickson, Hacking: The Art of Exploitation, 2nd Edition, 2008, ISBN-13: 978-1-59327-144-2.
5. Flemming Nielson (Author), Hanne R. Nielson (Author), Chris Hankin, Principles of Program Analysis, 2010, Springer, ISBN-13: 978-3642084744.
6. Jack Koziol (Author), David Litchfield (Author), Dave Aitel, Chris Anley, Sinan "noir" Eren, Neel Mehta, Riley Hassell, The Shellcoder's Handbook: Discovering and Exploiting Security Holes, John Wiley & Sons, 2004, ISBN: 978-0764544682.
7. Ed Skoudis, Tom Liston, Counter Hack Reloaded: A Step-by-Step Guide to Computer Attacks and Effective Defenses, 2nd Edition, Prentice Hall, ISBN-13: 978-0-13-148104-6.

18CS3061	Mobile AdHoc Network	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. experiment the relevant knowledge with Ad Hoc networks
2. develop a comprehensive understanding of Ad Hoc TCP protocols.
3. evaluate the performance of Ad Hoc routing protocols.

Course Outcomes:

The student will be able to

1. describe the working of various protocols for Ad Hoc Wireless Networks.
2. summarize the advantages and disadvantages of various protocols.
3. illustrate the working of routing protocols for Ad Hoc Wireless Networks.
4. analyze the design issues of MAC protocols and Routing protocols.
5. categorize the QoS schemes, energy management schemes.
6. predict the evolution of wireless networking technologies.

Module 1: Introduction to Ad Hoc Wireless Networks

Issues in Ad Hoc Wireless Networks - Ad Hoc Wireless internet - Issues in designing a MAC protocols for Ad Hoc Wireless Networks - classification of MAC protocols: content based protocol - Content based protocol with reservation Mechanisms - Content based protocol with scheduling Mechanisms - Mac protocols that use Directional Antennas.

Module 2: Routing Protocol for Ad Hoc Wireless Networks

Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks - classification of Routing Protocols - Table-Driven Routing Protocols - On-Demand Routing Protocols - Dynamic source routing protocol - Ad Hoc on-Demand Distance Vector routing protocol - hybrid routing protocols - Routing Protocols with Efficient Flooding Mechanisms - hierarchical Routing Protocols - power-aware protocols

Module 3: Quality of Service in Ad Hoc Wireless Networks

Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions - QoS Frameworks for Ad Hoc Wireless Networks - Qos Routing protocol - bandwidth routing protocol - on-demand link state Multipath Qos Routing protocol.

Module 4: Need for Energy Management in Ad Hoc Wireless Networks

Classification of Energy Management Schemes - Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes –

Module 5: Wireless Sensor Networks

Applications of Sensor Networks-Wireless Sensor Network Architecture - Data Dissemination - Data Gathering - MAC Protocols for Sensor Networks - Location Discovery.

Module 6: Evolution of wireless mobile technologies

2G mobile systems - 2.5G mobile wireless systems - 3G mobile wireless system - Core Network - 3G service and application - B3G challenge - GSM evolves to B3G - The future of AD Hoc Networking.

Reference Books:

1. 1.C.S.R.Murthy, Ad Hoc Wireless Networks: Architectures and Protocols, Dorling Kindersley, 2012, ISBN-13: 9780133007060.
2. George Aggelou, Mobile Ad Hoc Networks from Wireless Lans to 4G Networks, Tata McGraw - Hill Education, 2009, ISBN-13: 9780070677487.
3. C-K Toh, Ah Hoc Mobile Wireless Network Protocols and System, Dorling Kindersley, 2007, ISBN-13:9788131715109.
4. Perkins, Ad Hoc Networking, Dorling Kindersley, 2008, ISBN-13: 9788131720967.
5. Stefano Basagni, Marco Conti, Silvia Giordano, Ivan Stojmenovic, "Mobile Ad Hoc Networking", Wiley India Pvt Ltd, 2010, ISBN-13: 9788126527892.
6. Gianluigi Ferrari, Ozan K. Tonguz, "Ad Hoc Wireless Networks: A Communication Theoretic Perspective", Wiley, 2009, ISBN-13: 9788126523047

18CS3062	Mobile Applications and Services	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the basic concepts and principles in mobile computing.
2. apply major techniques involved and networks and systems issues.
3. implement mobile computing systems and applications.

Course Outcomes:

The student will be able to

1. identify the various applications and services of mobile computing.
2. describe the working of underlying wireless and mobile communication networks and their technical features.
3. illustrate the important issues of developing mobile computing systems and applications.
4. compare the working principle concepts of GSM,GPRS,WAP,CDMA, 3G.

5. formulate the security features of mobile computing.
6. explain the multimedia applications for mobile computing.

Module 1: Introduction and Architecture
Mobile Computing-Application and Services, Standards, Mobile computing Architecture.
Module 2: Mobile Computing
Design considerations for Mobile Computing, Mobile Computing through Telephony, Emerging Technologies Middleware and Gateways.
Module 3: Global system for Mobile Communication
Global system for mobile communication (GSM)-Short Message Service (SMS) - General Packet Radio Service (GPRS)
Module 4: Wireless Application Protocol (WAP)
Introduction to WAP-MMS-GPRS Applications-CDMA Introduction - Spread Spectrum - CDMA vs GSM-Wireless data-Third Generation Networks-Applications on 3G.
Module 5: Wireless LAN
Introduction-Intelligent Networks and Internetworking - Client programming, program for the Android OS.
Module 6: Voice over IP and Convergence
Multimedia-Networked multimedia application-Security issues- Security Protocols in mobile computing-New services.

Reference Books:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, Mobile Computing Technology, Applications and Service Creation, 2nd edition, Tata McGraw Hill, 2010. ISBN 978-00-701-4457-5
2. Reto Meier, Professional Android 4 Application Development, Third edition, Wrox, 2012. ISBN 978- 1118102275.
3. Uwe Hansmann, Lothar Merk, Martin S Nicklous, Thomas Stober, Principles of Mobile Computing, 2nd edition, Wiley, 2006. ISBN 978-81-812-8073-2
4. Prasant Kumar Pattnaik, Rajib Mall, Fundamentals of Mobile Computing, PHI Learning, 2012. ISBN 978- 81-203-4632-1
5. Raj Kamal, Mobile Computing, 2nd edition, Oxford University Press, 2011, ISBN 978-01-980-6891-4 5.
6. Reza B'far, Mobile Computing principles, 1st edition, Cambridge University Press, 2008, 978-05-216-9623-4

18CS3063	Mobile Computing and Communication	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the students to
1. describe the basic concepts and principles in mobile computing.
2. differentiate the concept of Wireless LANs, Mobile Networks, and Sensor Networks.
3. analyze the structure and components for Mobile IP and Mobility Management.

Course Outcomes:
The student will be able to
1. outline the basic principles and concepts in mobile Computing.
2. develop mobile applications to realize location-aware computing.
3. design algorithms for location estimations based on different positioning.
4. develop knowledge to administrate and to maintain a Wireless LAN.
5. recognize the important issues and concerns on security and privacy.
6. devise and develop applications that are mobile-device specific and demonstrate current practice in mobile communication contexts.

Module 1: Introduction

Mobile Computing-Networks- Middleware and Gateways-Developing Mobile computing applications – Security in Mobile computing- Application and Services, Standards, Mobile computing Architecture, Design considerations for Mobile Computing, Evolution of telephony- Mobile Computing through Telephony, Satellite communication systems- Developing and IVR application-Telephony Application Programming Interface(TAPI).

Module 2: Global system for Mobile Communication

Global system for mobile communication (GSM)-GSM architecture-GSM entities-Call Routing in GSM-PLMN interfaces-GSM addresses and identifiers-Network aspects in GSM-Mobile management-GSM frequency allocation-Mobile computing over SMS-Short Message Service (SMS) – Value added services through SMS-Accessing SMS bearer- General Packet Radio Service (GPRS) and Packet data network-GPRS network architecture and operations-Data services in GPRS-Applications and limitations of GPRS.

Module 3: Architectures for Mobile Computing

UMTS architecture-public land mobile network interfaces-user authentication-frequency reuse-channel assignment-local registration and update-handover procedures-CDMA-3G networks- IEEE 802.11 standard- IEEE 802.11b IEEE - IEEE 802.11a - IEEE 802.11g standard-HIPERLAN/2-IEEE 802.1x standard- IEEE 802.11i standard- IEEE 802.11e standard-Security issues-IP over 802.11 WLAN-Introduction to Wireless personal area network-Home RF-Bluetooth technology-IEEE 802.15.3 standard-home network.

Module 4: Wireless sensor network and Mobile Ad Hoc Network

Applications and requirements for Wireless Sensor Network- WSN architecture-802.15.4 standard-Zig Bee Protocol-Power conservation techniques-Network and Communications-Configuration of Sensor Networks-WSN and energy response applications-AODV-DSR-OLSR-TBRPF.

Module 5: Mobile IP

Agent advertisement message-Home network configurations-Registration Messages-Routing and tunneling- Security issues in Mobile IP-Mobile IP and Ad Hoc Networks-Bandwidth-Adaptive Behavior-Power Management- Interface Design-Heterogeneity of devices and Environments – Seamless mobility over heterogeneous Wireless Networks.

Module 6: Location Sensing and Wireless Sensor Network

Location sensing systems- taxonomy of location systems-GPS-Active badge-modeling location-Location-aware application for medical workers-Overview of wireless security issues-Security of data transmission-Next generation hackers.

Reference Books:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, “Mobile Computing Technology, Applications and Service Creation”, 2nd edition, 2010, Tata McGraw Hill, ISBN: 978-00-701-4457-5 2.
2. Mazliza Othman, “Principles of Mobile Computing and Communications”, 2007, Auerbach Publications, ISBN-10: 1420061585, ISBN-13: 978-1420061581.
3. Reza B'Far, “Mobile Computing Principles: Designing and Developing Mobile Applications with UML and XML”, 2004, Cambridge University Press, ISBN-10: 0521817331, ISBN-13: 978-0521817332.
4. M. Bala Krishna (Editor), Jaime Lloret Mauri (Editor), “Advances in Mobile Computing and Communications: Perspectives and Emerging Trends in 5G Networks”, CRC Press; 1 edition, 2016, ISBN-10: 1498701132, ISBN-13: 978-1498701136.
5. Amjad Umar, “Mobile Computing and Wireless Communications: Applications, Networks, Platforms, Architectures and Security”, 2004, NGE Solutions, ISBN-10: 0975918206, ISBN-13: 978-0975918203.

18CS3064	Multimedia Networks	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the deployment of multimedia applications on networked environments,
2. review a multimedia networking performance issues, multicasting and content distribution.
3. analyse the packet loss recovery and rate control for multimedia streaming

Course Outcomes

The student will be able to

1. explain how basic algorithms operate for multimedia encoding.
2. estimate the performance of a multimedia flow based on certain environmental, communication, and system settings.
3. analyse different network configurations, and estimate the impacts on multimedia streaming quality.
4. recommend a suitable equilibrium solution of multimedia content distribution based on specific network and user requirements.
5. understand the ability of communication and transmission devices to guarantee the minimum requirements
6. understand various rate control mechanism for media streaming applications

Module 1: Prelims

Overview of multimedia applications on the Internet; Requirements of multimedia applications; Hurdles in the deployment of multimedia application on the current Internet; Compression.

Module 2: Multimedia Networking Performance Issues

Performance parameters; Characteristics of multimedia traffic sources; Factors affecting performance; Review of empirical studies of audio/video streaming on the Internet; Video streaming on wireless channels.

Module 3: Multicast

Overview of IP multicast; Deployment issues with IP multicast; Application-level multicast.

Module 4: Content Distribution

Scalable streaming protocols for video-on-demand (periodic broadcast protocols, patching, bandwidth skimming protocols); Scalable bulk data distribution; Content Distribution Networks; Peer-to-peer streaming.

Module 5: Packet Loss Recovery

Packet loss recovery techniques for unicast audio/video streaming; Parity-Based Loss Recovery for Reliable Multicast Transmission; Reliable Multicast Transport Protocol (RMTP); Reliable Multicast Framework for Light-weight Sessions and Application Level Framing, Quality of Service**,** Integrated services; Differentiated services; Active Queue Management.

Module 6: Rate Control of Streaming Media

Review of TCP Congestion Control; TCP Vegas; Binomial congestion control; Unicast rate control protocols (e.g., RAP, TFRC); Multicast rate control protocols (e.g., RLM, FLID-DL, WEBRC).

Reference Books:

1. Mario Marques da Silva, "Multimedia Communications and Networking", CRC Press, 2012.
2. Larry L. Peterson and Bruce S. Davie, "Computer Networks- A Systems Approach", Morgan Kaufmann Publishers, 2007.
3. James F. Kurose and Keith W. Ross, "Computer Networking-A Top-Down Approach Featuring the Internet", Pearson, 2012.
4. Mark Wuthnow, Jerry Shih, Matthew Stafford, "IMS: A New Model for Blending Applications", Auerbach Publications, 2009.
5. Multimedia Communications: Protocols and Applications, F. Kuo, W. Effelsberg, and J.Garcia-Luna-Aceves, Prentice Hall PTR, 2000.
6. The Art of Computer Systems Performance Analysis, R. Jain, Wiley Interscience, 1991.

18CS3065	Network Management	L 3	T 0	P 0	C 3

Course Objectives:

Enable the student to

1. understand the foundations required to build network management architectures and protocols.
2. illustrate SNMP-based protocols that manage TCP/IP networks with real-world examples.
3. infer about RMON and network management tools and web based management techniques.

Course Outcomes

The student will be able to

1. describe basic network management concepts.
2. distinguish the characteristics and capabilities of various versions of SNMP.
3. prepare and schedule suitable network management strategies.
4. experiment and illustrate the usage of remote monitoring.
5. plan the management of a network by using the appropriate management tools.
6. compare and analyze various models of network management.

Module 1: Data Communications and Network Management Overview

Analogy of Telephone Network Management - Data and Telecommunication Network - Distributed Computing Environment - TCP/IP based Networks - Network Management: Goals - Organization and Functions - Network Management Organization and Architecture

Module 2: SNMP and Network Management

Standards - Network Management Tools - Organization Model - Information Model - Communication Model - ASN.1

Module 3: Snmpv1 Network Management

Organization and Information Models: Internet Organization and Standards - SNMP Model - Organizational Model - System Overview

Module 4: SNMPv2 and SNMPv3 management

Major changes in SNMPv2 - SNMPv2 System Architecture - Structure of Management Information - Management Information Base - SNMPv2 Protocol - Compatibility with SNMPv1 - Management SNMPv3: Key features - Documentation Architecture - SNMPv3 Applications - SNMPv3 MIB -Security - User-based Security Model

Module 5: SNMP management

RMON - Introduction - RMON SMI and MIB - RMON1 - RMON2 - Network Management Tools - Systems and Engineering: System Utilities - Network Statistics Measurements System - MIB Engineering

Module 6: Network Management Applications:

Configuration Management - Fault Management - Performance Management – Security Management - Accounting Management - Report Management.

Reference Books:

1. Mani Subramanian, “Network Management Principles and Practice”, Addison Wesley, 2012, ISBN: 9788131727591.
2. Sebastian Abeck, Adrian Farrel, “Network Management Know it all”, Elsevier Morgan Caufmann, 2009, ISBN: 9780123745989.
3. Stephen B. Morris, “Network Management, MIBs and MPLS: Principles Design and Implementation”, Pearson, 2008, ISBN-10: 0131011138, ISBN-13: 9780131011137.
4. Alexander clemm, “Network Management Fundamentals”, CISCO Press, 2006, ISBN: 1587201372.
5. Andrew S.Tanenbaum, “Computer Networks, Pearson Education”, 5th Edition, 2014, ISBN: 9789332518742, 9332518742.

18CS3066	Network Programming	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. learn the basics of socket programming using TCP Sockets.
2. apply socket options.
3. learn to develop macros for including Objects In MIB Structure.
4. recognize SNMPv1, v2 and v3 protocols & practical issues.

Course Outcomes:

The student will be able to

1. develop programs using TCP Sockets.
2. use Socket Options.
3. develop Macros for including Objects In MIB Structure
4. use SNMPv1, v2 and v3 protocols.
5. apply advanced programming techniques such as Broadcasting, Multicasting
6. analyse the requirements of a networked programming environment and identify the issues to be solved

Module 1: Sockets and application development

Introduction to Socket Programming – System Calls – Address conversion functions – POSIX Signal Handling – Server with multiple clients – Boundary conditions – Server process Crashes, Server host Crashes, Server Crashes and reboots, Server Shutdown – I/O Multiplexing – I/O Models -TCP echo client/server with I/O Multiplexing

Module 2: Socket options

Socket options – getsockopt and setsockopt functions – Generic socket options – IP socket options – ICMP socket options – TCP socket options – Multiplexing TCP and UDP sockets – SCTP Sockets – SCTP Client/server – Streaming Example – Domain name system – gethostbyname, gethostbyaddr, getservbyname and getservbyport functions – Protocol Independent functions in TCP Client/Server Scenario

Module 3: Advanced sockets

IPv4 and IPv6 interoperability – Threaded servers – Thread creation and termination – TCP echo server using threads – Mutex – Condition variables – Raw sockets – Raw socket creation – Raw socket output – Raw socket input – ping program – traceroute program

Module 4: Simple network management

SNMP network management concepts – SNMPv1 – Management information – MIB Structure – Object syntax – Standard MIB‟s – MIB-II Groups – SNMPv1 protocol and Practical issues.

Module 5: SNMP V2, V3 and RMO

Introduction to SNMPv2 – SMI for SNMPV2 – Protocol – SNMPv3 – Architecture and applications – Security and access control model – Overview of RMON.

Module 6: Remote login

Terminal line disciplines, Pseudo-Terminals, Terminal modes, Control Terminals, rlogin Overview, RPC Transparency Issues.

Reference Books:

1. W. Richard Stevens, “UNIX Network Programming Vol-I”, Third Edition, PHI Pearson Education, 2003.
2. William Stallings, “SNMP, SNMPv2, SNMPv3 and RMON 1 and 2”, Third Edition, Pearson Edition, 2009.
3. D.E. Comer, “Internetworking with TCP/IP Vol- III: Client-Server Programming and Application BSD Sockets Version”, Second Edition, Pearson Edition, 2003.
4. Elliotte Rusty Harold, Java Network Programming, Fourth Edition, O’Reilly
5. UNIX for Programmers and Users, 3rd Edition Graham GLASS, King abls, Pearson Education

18CS3067	Network Security	L 3	T 0	P 0	C 3

Course Objectives:

Enable the student to

1. explain the basic principles and practices of network security.
2. identify the fundamental techniques in implementing secure network communications.
3. prioritize the security countermeasures and improve application security.

Course Outcomes:

The student will be able to

1. recall the network security principles and practices.
2. explain the network architecture to enhance the design for improving security.
3. interpret virtual private network and wireless network security.
4. list the secure communication techniques of encryption, Steganography and digital watermarking.
5. appraise the various methods of application security.
6. Discuss the various security threat and response mechanisms.

Module 1: Network Security, Principles and Practices

Network Security Overview: Benefits of good security practices – Security methodology – Risk Analysis and defense Models: Threat definition and risk analysis – defense models – Access Control: Physical Security – Authentication and authorization controls – Data Security Architecture: principles of data security architecture – Application of data security architecture.

Module 2: Network Architecture

Network design considerations: introduction to secure network design – performance – availability – security - Firewalls: Understanding firewalls

Module 3: Virtual Private Network security and Wireless Network Security

Working of Virtual Private Network – VPN Protocols – Client/Server Remote Access vulnerabilities and threats - site to site networking vulnerabilities and threats – Wireless Network Security: Data link layer wireless security features, flaws and threats -

Module 4: Secure Communication

Secret Communication – Cryptography – symmetric and asymmetric encryption - Covert Communication – overview of Steganography – history – core areas of network security and relation to Steganography – principles of Steganography – Steganography compared to cryptography – Steganography versus digital watermarking

Module 5: Application Security

Principles of Application Security: Web Application Security – Regular Application Security – Embedded Application Security – Remote administration Security - Writing Secure Code: The golden rule – The Golden Secure rule

Module 6: Security and threat response

Intrusion Detection Response: malicious code – Common attacks – intrusion detection mechanisms - Honeypots – incident handling – Forensics: Legal requirements – Evidence Acquisition – Analysis - Integrated Cyber Security: Validating Security – Data Protection -

Reference Books:

1. Eric Cole, Ronald L. Krutz, James W. Conley, Network Security Bible, 2nd Edition, Wiley, 2009. ISBN-13: 978-0470502495.
2. Roberta Bragg, Matk Rhodes-Ousley, Keith Strassberg, Network Security: The Complete Reference, 1st Edition, McGraw Hill Education, 2017. ISBN-13: 978-0070586710.
3. Eric Maiwald, Network Security: A beginner's guide, 3rd edition, McGraw Hill publication, 2013. ISBN: 978-0-07-179570-8
4. William Stallings, Network Security Essentials Applications and Standards, 6th edition, Pearson Education, 2016. ISBN 13: 978-1-292-15485-5.

5. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: Private Communication in a public World, 2nd Edition, Pearson Education, 2016. ISBN-13: 978-9332578210.

18CS3068	Network Virtualization	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the concepts of virtualization and VMs
2. identify the needs of storage and network virtualization
3. apply the security models in virtual environment and manage the life cycle of VMs

Course Outcomes:

The students will be able to

1. understand the concept of virtualization and its types
2. employ the concepts of different virtual storage mechanisms
3. apply different virtual networking concepts
4. manage the life cycle of the VMs
5. use the security models in the virtual environment
6. mitigate the disaster using recovery techniques

Module 1: Virtualization

What is virtualization, Understanding, VMM, types of hypervisors. Virtualization techniques - para virtualization - full virtualization, - hardware assisted virtualization - hybrid virtualization, Virtual Machines Basics - Process Virtual Machines – System Virtual Machines –Emulation – Interpretation – Binary Translation, server virtualization models, Case Study KVM, Xen, VMware ESX and Hyper-V architectures

Module 2: Virtualization Infrastructure

Comprehensive Analysis – Resource Pool – Testing Environment –Server Virtualization – Virtual Workloads – Provision Virtual Machines – virtualization of CPU, Memory: memory ballooning, memory swapping, I/O devices – virtual clusters and Resource Management – Virtualization for data center automation

Module 3: Network Virtualization

Isolated virtual network, routed virtual network, NATed virtual network, bridged network, MacVTap, PCI passthrough, linux bridges, limitations of linux bridge, Introduction to OpenvSwitch, VLAN's with OpenvSwitch, distributed virtual switch, applying traffic rate limiting, overlay networks, OpenvSwitch tunnels with VxLAN, Network port mirroring, Case Study VMWare NSX

Module 4: Storage Virtualization

Storage Design: Storage design factors, storage efficiency, Vsphere Storage Features, Capacity: RAID options, Estimating capacity requirements, VMFS capacity limits, data stores, thin provisioning, data deduplication, Array compression, Downside of saving space, Performance: Measuring storage performance, calculate disk IOPS, local storage, shared storage, Protocol: fibre channel, iSCSI, Multipathing: SAN multipathing, NAS multipathing, Virtual disk formats, copy on write formats, converting VM disk format, Open Virtualization Format, storage migration, Case Study: ceph

Module 5: VM Life Cycle Management

VNC graphic service, SPIC graphic Server, VM migration - offline migration - online migration - Benefits of VM migration, create a VM using template, Working with internal snapshots, physical to virtual conversions and its types, Case study: v2v and p2v migration tools.

Module 6: Virtualization Security and Future Direction

VMMs as microkernels, Unikernels, chroot, jails, containers, cloudlets, Secure resource pools, secure virtual service offerings, Apply the castle defence system - critical information - physical protection - operating system hardening - information access - external access, develop system protection strategies, business continuity essentials, business continuity strategy, Case Study: Kubic, CoreOS, OCI

Reference Books:

1. Virtual Machines: Versatile Platforms for Systems and Processes, James Edward Smith, Jim Smith, Ravi Nair, Elsevier, 2005, ISBN: 1558609105
2. Nelson Ruest, Danielle Ruest, Virtualization, A Beginner's Guide, McGraw Hill Professional, 2009, ISBN: 0070147191
3. Humble Devassy Chirammal, Prasad Mukhedkar, Anil Vettathu, Mastering KVM Virtualization, 2016, Packt Publishing Ltd, ISBN: 1784396915
4. Forbes Guthrie, Scott Lowe, Kendrick Coleman, VMware vSphere Design, John Wiley & Sons, 2013, ISBN-13: 978-1118407912

18CS3069	Operating System Design	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. provide comprehensive and up-to-date coverage of the major developments in distributed operating system, multi-processor operating system and database operating system.
2. impart knowledge on important theoretical foundations including process synchronization, concurrency, event ordering, mutual exclusion, deadlock, agreement protocol,
3. identify the key issues security, recovery and fault tolerance mechanisms.

Course Outcomes:

The student will be able to

1. recall the theoretical foundation of distributed operating systems.
2. classify various synchronization problems.
3. analyze the solution for mutual exclusion.
4. examine a fault tolerant system.
5. discover various security essentials.
6. assess the theoretical aspects of concurrency control.

Module 1: Synchronization Mechanisms

Distributed Operating Systems -Architectures of Distributed Systems, Theoretical Foundations-Distributed Mutual Exclusion-Distributed Deadlock detection - Agreement Protocols.

Module 2: Distributed Resource Management

Distributed File Systems - Mechanisms for Building distributed Filesystem- Distributed Shared memory-Distributed Scheduling.

Module 3: Failure Recovery

Fault Tolerance introduction -Recovery -Classification of Failure -Backward and Forward error Recovery - Recovery in Concurrent Systems - Synchronous and Asynchronous Checkpoint and Recovery - Fault Tolerance.

Module 4: Protection And Security

Resource Security and protection -Introduction to Resource Security and Protection - Preliminaries -The Access Matrix Model -Implementation of Access Matrix - The Lock-Key method.

Module 5: Multiprocessor Operating Systems

Multiprocessor System Architectures – Interconnection Networks for Multiprocessor Systems – Caching – Design Issues – Threads – Process Synchronization – Processor Scheduling.

Module 6: Database Operating Systems

Introduction to Database Operating systems - Concurrency Control, Theoretical Aspects - Concurrency Control Algorithms.

Reference Books:

1. Ajay D. Kshemkalyani, MukeshSinghal, Distributed Computing: Principles, Algorithms, and Systems, 2011, Cambridge University Press; Reissue edition. ISBN-10: 0521189845.

2. Mary Gorman, Todd Stubbs, Introduction to Operating Systems: Advanced Course, Course Technology, 2003. ISBN: 9780619055301.
3. Mukesh Singhal, Niranjan G.Shivaratri, Advanced Concepts in Operating Systems Distributed, Database, and Multiprocessor Operating Systems, Tata McGraw-Hill, 1994. ISBN: 0-07-047268-8.
4. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, fifth Edition 2011, ISBN-10: 0132143011.
5. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, JohnWiley and Sons, Seventh Edition, 2006. ISBN: 9812-53-176-9.
6. Yair Wiseman, Song Jiang, Advanced Operating Systems and Kernel Applications: Techniques and Technologies, IGI Global Snippet, 2010, ISBN-1605668516.

18CS3070	Optimization Techniques	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the mathematical formulation of real world problems.
2. optimize these mathematical problems using nature based algorithms. And the solution is useful especially for NP-Hard problems.
3. examine several applications of constrained and unconstrained optimization for real time problems

Course Outcomes:

The student will be able to

1. define and use optimization terminology and concepts.
2. formulate optimization problems.
3. understand and apply the concept of optimality criteria for various types of optimization problems.
4. solve various constrained and unconstrained problems in single variable as well as multivariable.
5. apply the methods of optimization in real life situation
6. implement basic optimization algorithms in a computational setting and apply existing optimization software packages to solve engineering problems.

Module 1: Optimization Overview

Engineering application of Optimization, Formulation of design problems as mathematical programming problems.

Module 2: Optimization Algorithm structure

General Structure of Optimization Algorithms, Constraints, The Feasible Region.

Module 3: Mathematical Background for optimization

Branches of Mathematical Programming: Optimization using calculus, Graphical Optimization, Linear Programming, Quadratic Programming, Integer Programming, Semi Definite Programming.

Module 4: Optimization Algorithms

Optimization Algorithms like Genetic Optimization, Particle Swarm Optimization, Ant Colony Optimization etc.

Module 5: Problem Formulation

Real life Problems and their mathematical formulation as standard programming problems.

Module 6: Application of optimization techniques

Recent trends: Applications of ant colony optimization, genetics and linear and quadratic programming in real world applications.

Reference Books:

1. Laurence A. Wolsey (1998). Integer programming. Wiley. ISBN 978-0-471-28366-9.

2. Andreas Antoniou, Practical Optimization Algorithms and Engineering Applications, 2007, Springer
3. Edwin K., P. Chong & Stanislaw h. Zak, An Introduction to Optimization, 2013, Wiley
4. Dimitris Bertsimas; Robert Weismantel (2005). Optimization over integers. Dynamic Ideas. ISBN 978-0-9759146-2-5.
5. John K. Karlof (2006). Integer programming: theory and practice. CRC Press. ISBN 978-0-8493-1914-3.
6. H. Paul Williams (2009). Logic and Integer Programming. Springer. ISBN 978-0-387-92279-9.
7. Michael Jünger; Thomas M. Liebling; Denis Naddef; George Nemhauser; William R. Pulleyblank; Gerhard Reinelt; Giovanni Rinaldi; Laurence A. Wolsey, eds. (2009). 50 Years of Integer Programming 1958-2008: From the Early Years to the State-of-the- Art. Springer. ISBN 978-3- 540-68274-5.
8. Der-San Chen; Robert G. Batson; Yu Dang (2010). Applied Integer Programming: Modeling and Solution. John Wiley and Sons. ISBN 978-0-470-37306-4.

18CS3071	Parallel Algorithms	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand alternative to sequential model
2. gain expertise in parallel algorithm performance measure
3. understand and apply application of parallel algorithm in different domain

Course Outcomes:

The student will be able to

1. elaborate parallel computing model
2. outline the various performance measure
3. analyze the various parallel sorting networks
4. distinguish the various parallel searching algorithm
5. select the ideal graph algorithms
6. estimate performance analysis

Module 1: Introduction

Sequential model, need of alternative model, parallel computational models such as PRAM, LMCC, Hypercube, Cube Connected Cycle, Butterfly, Perfect Shuffle Computers, Tree model, Pyramid model, Fully Connected model, PRAM-CREW, EREW models, simulation of one model from another one.

Module 2: Performance Measures

Performance Measures of Parallel Algorithms, speed-up and efficiency of PA, Cost optimality, An example of illustrate Cost-optimal algorithms- such as summation, Min/Max on various models.

Module 3: Parallel Sorting Networks

Parallel Sorting Networks, Parallel Merging Algorithms on CREW/EREW/MCC/, Parallel Sorting Networks on CREW/EREW/MCC/, linear array

Module 4: Parallel Searching Algorithm

Parallel Searching Algorithm, Kth element, Kth element in X+Y on PRAM, Parallel Matrix Transportation and Multiplication Algorithm on PRAM, MCC, Vector-Matrix Multiplication, Solution of Linear Equation, Root finding.

Module 5: Graph Algorithms

Connected Graphs, search and traversal, Combinatorial Algorithms- Permutation, Combinations, Derangements.

Module 6: Case Study

Case study of parallel sorting networks, which include CREW, EREW and their performance analysis for various problems.

Reference Books:

1. M. J. Quinn, Designing Efficient Algorithms for Parallel Computer, 2009, McGraw Hill.
2. S.G. Akl, Design and Analysis of Parallel Algorithms, 1989, Prentice-hall
3. S.G. Akl, Parallel Sorting Algorithm, 1985, Academic Press
4. C. Xavier, S. S. Iyengar, Introduction to parallel algorithms, 1998, Wiley Interscience publication.

18CS3072	Parallel Programming Tools and Models	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. classify parallel architectures parameters that are essential for the classification of modern parallel processing systems.
2. apply the methodologies employed for synchronization and memory consistency and cache coherence in shared memory systems.
3. demonstrate GPU programming and message passing programming architectures.

Course Outcomes:

The student will be able to

1. understand the need for parallel programming with multi-core and muliprocessors.
2. identify the techniques to share the application data using shared memory and caches.
3. demonstrate the process of developing a parallel programs and interaction.
4. apply the various kinds synchronization models with consistency using UNIX, POSIX and OpenMP.
5. analyse the performance of shared memory systems based parameters like consistency, speed, and accuracy.
6. create CUDA based parallel programming models for scientific applications.

Module 1: Introduction

Why Parallel Computing - Parallel Hardware and Software - Processes and Threads - Programming Models - Shared Memory and Message Passing - Speedup and Efficiency - Amdahl's Law.

Module 2: Parallel Hardware

Multi-cores – Multiprocessors – SIMD Systems – MIMD Systems – Shared Memory - Message Passing Architectures – Cache Coherence - Sequential Consistency.

Module 3: Parallel Software

Parallel Program Design - Dependence analysis - Domain decomposition, Static Task assignment – Dynamic Task assignment - Performance issues - 4C cache misses - Inherent and Artifactual Communication - False Sharing - Computation-to-Communication Ratio - Hot Spots - Staggered Communication.

Module 4: Shared Memory Parallel Programming

Synchronization Locks and Barriers - Efficient lock implementation, Lock algorithms - Relaxed Consistency Models, High-level language memory models - Developing parallel programs with UNIX fork model - IPC with shared memory and message passing - UNIX semaphore - Developing parallel programs with POSIX - Developing parallel programs with OpenMP directives.

Module 5: GPU Programming

GPU architecture - Introduction to CUDA Programming, Concept of SIMD and SIMT Computation - Thread blocks – Warps - Global memory - Shared memory -Thread Divergence in Control Transfer.

Module 6: Message Passing Programming

Distributed Memory Model - Introduction to Message Passing Interface (MPI) - Synchronization as Send/Recv Pair - Asynchronous Send/Recv - Collective Communication – Reduce - Broadcast, Data distribution – Scatter – Gather - MPI derived data types.

Reference Books:

1. Peter S. Pacheco, "An Introduction to Parallel Programming", Morgan Kaufmann Publisher, 2011, ISBN: 9380931751, 9789380931753
2. Bertil Schmidt, Jorge Gonzalez-Dominguez, Christian Hundt, Moritz Schlarb, "Parallel Programming: Concepts and Practice", Morgan Kaufmann Publisher, 2017, ISBN: 0128498900, 9780128498903.
3. David B. Kirk , Wen-mei W. Hwu, "Programming Massively Parallel Processors A Hands-on Approach", Morgan Kaufmann Publisher, 2016, ISBN: 0128119861, 978-0128119860
4. Zbigniew J. Czech, "Introduction to Parallel Computing", Pearson Publisher, 2017, ISBN: 1107174392, 9781107174399.
5. Maurice Herlihy, Nir Shavit, "The Art of Multiprocessor Programming", Morgan Kaufmann, Revised First edition, 2012, ISBN: 0123973376, 978-0123973375.
6. Michael Quinn, "Parallel Computing: Theory and Practice", McGraw-Hill Publisher, 2017, ISBN: 0070495467, 9780070495463.
7. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, "Introduction to Parallel Computing", Second Edition, Reprint 2012, Pearson Education, ISBN-13: 9788131708071

18CS3073	Penetration Testing and Vulnerability Analysis	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. compare alternative tools and approaches for Intrusion Detection through quantitative analysis to determine the best tool or approach to reduce risk from intrusion
2. identify and describe the parts of all intrusion detection systems and characterize new and emerging IDS technologies according to the basic capabilities all intrusion detection systems share
3. analyze intrusion detection alerts and logs to distinguish attack types from false alarms

Course Outcomes:

The student will be able to

1. apply knowledge of the fundamentals and history of Intrusion Detection in order to avoid common pitfalls in the creation and evaluation of new Intrusion Detection Systems.
2. use various protocol analyzers and Network Intrusion Detection Systems as security tools to detect network attacks and troubleshoot network problems
3. evaluate the security an enterprise and appropriately apply Intrusion Detection tools and techniques in order to improve their security posture.
4. implement tools and techniques of Anomaly Detection Systems
5. complete hands-on exercises and case projects for testing and evaluating various Malware detection techniques.
6. classify and analyze Email/IM security issues and Insider Threat issues.

Module 1: Introduction to Intrusion Detection

The state of threats against computers, and networked systems-Overview of computer security solutions and why they fail-Vulnerability assessment, firewalls, VPN's -Overview of Intrusion Detection and Intrusion Prevention Network and Host-based IDS

Module 2: **Classes of attacks and attackers**

Classes of attacks - Network layer: scans, denial of service, penetration Application layer: software exploits, code injection-Human layer: identity theft, root access-Classes of attackers-Kids/hackers/sop Hesitated groups-Automated: Drones, Worms, Viruses

Module 3: Snort

A General IDS model and taxonomy, Signature-based Solutions, Snort, Snort rules, Evaluation of IDS, Cost sensitive IDS

Module 4: Anomaly Detection Systems

Anomaly Detection Systems and Algorithms-Network Behavior Based Anomaly Detectors (rate based)-Host-based Anomaly Detectors-Software Vulnerabilities State transition, Immunology, Payload Anomaly Detection

Module 5: Attack and Malware detection

Attack trees and Correlation of alerts-Autopsy of Worms and Botnets-Malware detection-Obfuscation, polymorphism-Document vectors

Module 6: Email/IM security issues and Insider Threat issues

Email/IM security issues-Viruses/Spam-From signatures to thumbprints to zeroday detection-Insider Threat issues-Taxonomy-Masquerade and Impersonation Traitors, Decoys and Deception-Future: Collaborative Security

Reference Books:

1. Peter Szor, The Art of Computer Virus Research and Defense Symantec Press ISBN 0-321305453
2. Markus Jakobsson and Zulfikar Ramzan,Crimeware, Understanding New Attacks and Defenses, Symantec Press, ISBN: 978-0-321-50195-0 2008
3. S. Stolfo, S. Bellovin, S. Hershkop, A. Keromytis, S. Sinclair, S. Smith, Insider Attack and Cyber Security: Beyond the Hacker, eds. Springer ISBN-13: 978-0-387-77321-6 2008.
4. Russell et al, Stealing the Network: How to Own the Box Syngress Publishing ISBN: 1-931836-87-6.
5. Rafeeq Ur Rehman, Intrusion Detection with SNORT: Advanced IDS Techniques Using SNORT, Apache, MySQL, PHP, and ACID, , Prentice Hall PTR ISBN: 0131407333 2003.

18CS3074	Quantum Computing	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to:

1. understand the significance of Qubits and identify the quantum states.
2. comprehend the matrices, operators and linear and commutator algebra in quantum computing
3. apply the quantum computing concepts in latest research issues and applications

Course Outcomes:

The student will be able to

1. describe the Qubit vector spaces and quantum states
2. comprehend the vectors, matrices and operators applied on vectors, matrices.
3. compute the algebra and demonstrate the uncertainty principle, decomposition operations.
4. construct the inner products and Tensor products and apply the density operator.
5. distinguish the quantum states and measures.
6. summarize the quantum computing techniques and apply them in recent research problem.

Module 1: Qubit and Quantum States

The Qubit, Vector Spaces. Linear Combination Of Vectors, Uniqueness of a spanning set, basis & dimensions, inner Products, orthonormality, gram-schmidt orthogonalization, bra-ket formalism, the Cauchyschwarez and triangle Inequalities.

Module 2: Matrices and Operators

Observables, The Pauli Operators, Outer Products, The Closure Relation, Representation of operators using matrices, outer products & matrix representation, matrix representation of operators in two dimensional spaces, Pauli Matrix, Hermitian unitary and normal operator, Eigen values & Eigen Vectors, Spectral Decomposition, Trace of an operator, important properties of Trace, Expectation Value of Operator, Projection Operator, Positive Operators.

Module 3: Commutator Algebra

Commutator Algebra, Heisenberg uncertainty principle, polar decomposition & singular values, Postulates of Quantum Mechanics.

Module 4: Tensor Products and Density Operator
Representing Composite States in Quantum Mechanics, Computing inner products, Tensor products of column vectors, operators and tensor products of Matrices. Density Operator: Density Operator of Pure & Mix state, Key Properties, Characterizing Mixed State, Practical Trace & Reduce Density Operator, Density Operator & Bloch Vector.

Module 5: Quantum Measurement Theory
Distinguishing Quantum states & Measures, Projective Measurements, Measurement on Composite systems, Generalized Measurements, Positive Operator- Valued Measures.

Module 6: Research Trends and Applications
Recent trends in Quantum Computing Research, Quantum Computing Applications of Genetic Programming.

Reference Books:

1. Zdzislaw Meglicki, Quantum Computing Without Magic: Devices, The MIT Press Cambridge, Massachusetts,2008, ISBN-13: 978-0262135061.
2. Vishal Sahni, Quantum Computing, Tata McGraw-Hill, 2011. ISBN-13: 978-0-07-065700- 7, ISBN-10: 0-07-065700-9.
3. Phillip Kaye, Raymond Laflamme, An Introduction to Quantum Computing, Oxford University Press, 2010. ISBN-10: 0-19-85700-07, ISBN-13: 978-0-19-857000-4.
4. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information ,Cambridge University Press,10th anniversary edition, December 2010. ISBN-10: 0-52-16350-39, ISBN-13: 978-0-52- 163503-5.
5. Willi-Hans Steeb, Yorick Hardyi World Scientific, 2016. ISBN-10: 9-81-25674-02, ISBN-13: 978-9-81-256740-6.
6. Mika Hirvensalo, Quantum Computing, Springer, 2004, ISBN - 3540407049

18CS3075	Recommender System	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to

- study the design of recommender systems: the underlying concepts, design space, and tradeoffs.
- learn techniques for making recommendations, including non-personalized, content-based, and collaborative filtering.
- Automate a variety of choice-making strategies with the goal of providing affordable, personal, and high-quality recommendations.

Course Outcomes:
The student will be able to

- understand the basic concepts behind recommender systems--software tools to recommend or evaluate products, information, or other options for users.
- understand the design space of recommender systems.
- design recommendations for a particular application domain, as well as critique a design to point out its strengths and weaknesses.
- design all types of recommender systems.
- analyze the types of recommender systems
- evaluate recommender systems, based on variety of metrics and the strengths, weaknesses, and use-cases for each.

Module 1: Introduction
Overview of Information Retrieval, Retrieval Models, Search and Filtering Techniques: Relevance Feedback, User Profiles, Recommender system functions, Matrix operations, covariance matrices, Understanding ratings, Applications of recommendation systems, Issues with recommender system.

Module 2: Content-based Filtering
High level architecture of content-based systems, Advantages and drawbacks of content based filtering, Item profiles, Discovering features of documents, pre-processing and feature extraction, Obtaining item features from tags, Methods for learning user profiles, Similarity based retrieval, Classification algorithms.

Module 3: Collaborative Filtering
User-based recommendation, Item-based recommendation, Model based approaches, Matrix factorization, Attacks on collaborative recommender systems.

Module 4: Hybrid approaches
Opportunities for hybridization, Monolithic hybridization design: Feature combination, Feature augmentation, Parallelized hybridization design: Weighted, Switching, Mixed, Pipelined hybridization design: Cascade Meta-level, Limitations of hybridization strategies

Module 5: Evaluating Recommender System
Introduction, General properties of evaluation research, Evaluation designs: Accuracy, Coverage, confidence, novelty, diversity, scalability, serendipity, Evaluation on historical datasets, Offline evaluations.

Module 6: Types of Recommender Systems
Recommender systems in personalized web search, knowledge-based recommender system, Social tagging recommender systems, Trust-centric recommendations, Group recommender systems.

Reference Books:

1. Jannach D., Zanker M. and FelFering A., Recommender Systems: An Introduction, 1st edition, Cambridge University Press (2011), ISBN: 978-0521-49336-9.
2. Charu C. Aggarwal, Recommender Systems: The Textbook, 1st edition, Springer (2016), ISBN: 978-3-319-29657-9.
3. Ricci F., Rokach L., Shapira D., Kantor B.P., Recommender Systems Handbook, 1st edition Springer(2011), ISBN: 978-1-4899-7637.
4. Manouselis N., Drachsler H., Verbert K., Duval E., Recommender Systems For Learning, 1st edition Springer (2013), ISBN: 978-1-4614-4361-2.

18CS3076	Routing Algorithms	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. learn in-depth about packet routing in computer communication networks.
2. understand comprehensive details of routing algorithms, protocols.
3. gain knowledge on the concepts of wireless routing.

Course Outcomes:
The student will be able to
1. understand the fundamentals and requirements for packet routing in computer communication networks.
2. design the IP addressing scheme of the complex campus network.
3. decide the routing protocol for any level of complex network design.
4. deal with the different routing protocols requires to be configured in real routers along with the framework of the concerned routing algorithms.
5. able to work towards next generation routing and in the domain of wireless networking.
6. implement the routing concepts in real world networking scenarios.

Module 1: Networking and Network Routing
Introduction, Addressing and Internet Service: An Overview, Network Routing: An Overview, IP Addressing, Routing Algorithms: Shortest Path and Widest Path: Bellman–Ford Algorithm and the Distance Vector Approach, Dijkstra's Algorithm, Comparison of the Bellman–Ford Algorithm and

Dijkstra's Algorithm, Shortest Path Computation with Candidate Path Caching, Widest Path Computation with Candidate Path Caching, Widest Path Algorithm, k-Shortest Paths Algorithm

Module 2: Routing Protocols, Framework and Principles

Routing Protocol, Routing Algorithm and Routing Information, Representation and Protocol Messages, Distance Vector Routing Protocol, Link State Routing Protocol, Path Vector Routing Protocol, Link Cost

Module 3: IP Routing and Distance Vector Protocol Family

Routers, Networks, and Routing Information: Some Basics, Static Routes, Routing Information Protocol Version 1 (RIPv1), Routing Information Protocol Version 2 (RIPv2), Interior Gateway Routing Protocol (IGRP), Enhanced Interior Gateway Routing Protocol (EIGRP), Route Redistribution.

Module 4: OSPF and Integrated IS-IS

OSPF: Protocol Features, OSPF Packet Format, Examples of Router LSAs and Network LSAs, Integrated IS-IS: Key Features, Similarities and Differences Between IS-IS and OSPF

Module 5: BGP

A Brief Overview, Basic Terminology, BGP Operations: Message Operations, BGP Timers, BGP Configuration Initialization, Two Faces of BGP: External BGP and Internal BGP, Path Attributes, BGP Decision Process, Internal BGP Scalability, Significance of Route Flap Dampening, BGP Additional Features, Finite State Machine of a BGP Connection.

Module 6: Routing in Ad hoc Network

Introduction to Ad hoc Networks – Features/ Characteristics, Types and Applications, Limitations, Advantages and Disadvantages, Classification of Routing Protocols in Ad hoc Networks – Proactive Routing Protocols (DSDV, OLSR), Reactive Routing Protocols (DSR, AODV), Hybrid Routing Protocols (ZRP)

Reference Books:

1. Deepankar Medhi, Kartikeyan Ramasamy , "Network Routing – Algorithms, Protocols, Architecture", Morgan Kauffman Series Publication. 2nd edition. 2017, 978-0-12-8007372.
2. Subir Kumar Sarkar, T G Basavaraju and C Puttamadappa, "Ad Hoc Mobile Wireless Networks – Principles, Protocols and Applications", Auerbach publications. 2007, 978-1-4200-6222-9.
3. Dharma Prakash Agrawal and Carlos De Morais Cordeiro, "Adhoc and Sensor Networks –Theory and Applications", World Scientific publication. 2011, 2nd edition 978-981-4338-88-2.
4. Misra, Sudip, and Sumit Goswami. Network Routing: Fundamentals, Applications, and Emerging Technologies. John Wiley & Sons, 2017. 978 111 9029380.

18CS3077	Secure Coding	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the basics of secure programming.
2. understand the most frequent programming errors leading to software vulnerabilities.
3. understand and protect against security threats and software vulnerabilities.

Course Outcomes:

The student will be able to

1. gain knowledge on how to develop secure software
2. understand the causes of security vulnerabilities and how they are exploited
3. real time software and vulnerabilities associated with them.
4. interrelate security and software engineering.
5. design cross site scripting for security
6. prepare case study on cross site scripting

Module 1: Introduction to software security

Managing software security risk – Selecting software development technologies – An open source and closed source – Guiding principles for software security – Auditing software – Buffet overflows – Access control – Race conditions – Input validation – Password authentication

Module 2: Anti-tampering
Protecting against denial of service attack – Copy protection schemes – Client-side security – Database security – Applied cryptography – Randomness and determinism.
Module 3: Buffer Overrun
Format String Problems – Integer Overflow – and Software Security Fundamentals – SQL Injection – Command Injection – Failure to Handle Errors – and Security Touchpoints
Module 4: Cross Site Scripting
Magic URLs – Weak Passwords – Failing to Protect Data – Weak random numbers – improper use of cryptography.
Module 5: Information Leakage
Race Conditions – Poor usability – Failing to protect network traffic – improper use of PKI – trusting network name resolution
Module 6: Case study of Cross Site Scripting
Magic URLs – weak Passwords Buffet overflows – Access control – Race conditions

Reference Books:

1. Viega, M. Messier. Secure Programming Cookbook, O'Reilly,2003.
2. M. Howard, D. LeBlanc. Writing Secure Code, Microsoft, 2003.
3. J. Viega, G. McGraw. Building Secure Software, Addison Wesley, 2002
4. Kenneth van Wyk, Mark Graff. Secure Coding: Principles and Practices, O'Reilly Media, 2009

18CS3078	Secure Software Design and Enterprise Computing	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. aware of various issues like weak random number generation, information leakage, poor usability, and weak or no encryption on data traffic
2. understand the techniques for successfully implementing and supporting network services on an enterprise scale and heterogeneous systems environment
3. design secure software containing minimum vulnerabilities and flaws.

Course Outcomes:
The student will be able to
1. differentiate between various software vulnerabilities and perform software security analysis
2. identify software process vulnerabilities for an organization
3. monitor resources consumption in a software.
4. interrelate security and software development process.
5. maintain a directory-based server infrastructure in a heterogeneous systems environment
6. manage and troubleshoot a network running multiple services

Module 1: Secure Software Design
Software vulnerabilities and software security analysis - Fundamental software security design - Security testing and quality assurance**.**
Module 2: Enterprise Application Development
Enterprise software applications, Distributed N-tier software application, Business and data tiers of an enterprise software application -Enterprise database system
Module 3: Enterprise Systems Administration
Directory-based server infrastructure in a heterogeneous systems environment - Server resource utilization for system reliability and availability - Network services (DNS/DHCP/Terminal Services/Clustering/Web/Email).
Module 4: Shared Memory Parallel Programming
Parallel programming-Requirements of an enterprise network - Managing enterprise network

Module 5: Exception Handling
Insecure exceptions handling - Command/SQL injection - Web and mobile applications against attackers- Vulnerabilities and flaws.
Module 6: Case Study
Case study of DNS server- DHCP configuration - SQL injection attack.

Reference Books:

1. Theodor Richardson, Charles N Thies, Secure Software Design, Jones & Bartlett , ISBN-13: 9781449626327
2. Kenneth R. van Wyk, Mark G. Graff, Dan S. Peters, Diana L. Burley, Enterprise Software Security, Addison Wesley, 2015, ISBN-13: 978-0-321-60411-8

18CS3079	Security and Privacy for Big Data	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. introduce the emerging trends and issues in security and privacy in current web and mobile services
2. understand the privacy polices around the globe.
3. explore various privacy models.

Course Outcomes
The student will be able to
1. identify the security and privacy issues to be tackled.
2. choose and apply appropriate approaches, tools and technology to provide privacy and security
3. analyze the risk occurred in computer or networks
4. infer the masking methods, information loss
5. design and simulate the Hadoop security services.
6. evaluate security and privacy solution

Module 1: Introduction to Privacy in Big data
Introduction to big data – Characteristics of Data – Evolution of Big Data – Definition of Big Data – Challenges with Big Data – Big Data and Privacy – Privacy versus Security and Safety – The Right to Privacy in the Digital Age – Privacy in US – Privacy in Europe – Privacy Without Borders – Networked Privacy.
Module 2: Cryptography and Security
Cryptography and Private Key (Symmetric) Cryptography – Public-Key (Asymmetric) Cryptography - Anonymity and attacks against anonymity – - Differential privacy – Efficiency, utility, privacy trade-offs – Real world use cases and applications
Module 3: User Privacy and Dimensions
Classification of protection procedures – Dimensions – Respondent and Holder privacy – Data driven methods – Computation Driven Methods – Result driven approaches – Tabular data – User privacy in communication – User privacy in information retrieval – Private Information Retrieval.
Module 4: Privacy Models and Disclosure Risk Measures A Boolean or measurable condition – attribute disclosure – identity disclosure – matching and integration – probabilistic record linkage – distance-based record linkage – k-anonymity for identity disclosure – Discussion on record linkage
Module 5: Masking Methods, Information Loss
Perturbative methods – Non-perturbative methods – Synthetic data generators – masking methods and k-anonymity – data protection procedures for constrained data – masking methods and big data – Information loss measures – generic information loss measures – Specific information loss measures – information loss and big data.

Module 6: Hadoop Security
Introduction – Security architecture – Securing distributed systems: Threat categories – Threat and risk assessment – Vulnerabilities – Defense in depth – System Architecture: Operating environment – Network security – Hadoop roles and separation strategies – Operating system security.

Reference Books:

1. Privacy and Big data, Terence Craig, Mary E. Ludloff, O'Reilly media.
2. Data Privacy: Foundations, New Developments and the Big Data Challenge, Torra, Vicenç. Springer International Publishing
3. Hadoop Security, Joey Echeverria, Ben Spivey, O'Reilly Media, Inc.
4. Privacy in the Age of Big Data, Theresa Payton, Ted Claypoole, Rowman & Littlefield.
5. Privacy and Security Policies in Big Data, Tamane, Sharvari, Solanki, Vijender Kumar, Dey, Nilanjan, IGI Global.

18CS3080	Security Assessment and Risk Analysis	L	T	P	C
		3	0	0	3

Course objectives:
Enable the student to
1. recognize some analysis methodologies to realistic risk analysis problems,
2. discuss the strengths and weaknesses of different analytical techniques.
3. understand the vulnerabilities and its consequences of risk assessment.

Course Outcomes:
The student will be able to
1. assess organizational networks, systems, and information storage solutions to recommend an information assurance security plan that protects the organization by decreasing risk and mitigating vulnerabilities.
2. examine the business case for information security.
3. evaluate and develop strategic metrics to help determine information security outcomes.
4. assess security governance objectives and risk management objectives.
5. develop a cost-effective security strategy and synthesize meaningful security program metrics.
6. design relevant information security management metrics by analyzing incident management and response data.

Module 1: Introduction
Role of Information security manager-ensuring quality information security assessment-security risk assessment-defining security risk assessment-need for security risk assessment-security risk assessment secondary benefits-gap assessment-compliance audit-security audit-vulnerability scanning-penetration testing-Ad Hoc testing-social engineering- Information security risk assessment basics-project definition and preparation-data gathering-risk analysis-risk mitigation-risk reporting and resolution.

Module 2: Security Risk assessment preparation
Ensuring project success-success definition-setting the budget-determining the objective-limiting the scope-identifying system boundaries-specifying the rigor-sample scope statements-project description-team introduction-review business mission-identify critical systems-identify assets-asset valuation-identifying threats-determine expected controls.

Module 3: Data gathering and administration
Sampling-RIIOT method of data gathering-Threats and safe guards-Human resources-Organizational structure- Information control- Business continuity-System security-RIIOT method: administrative data gathering-review administrative documents.

Module 4: Technical data gathering
Technical threats and safe guards-Information control-Business continuity-System security-secure architecture-components-configuration-RIIOT Method: Technical data gathering-Review technical documents-Interview technical personnel-Inspect technical security controls-Observe technical personnel behavior.

Module 5: Information security Risk Assessment
Compiling observations from organizational risk documents-preparation of threat and vulnerability catalogs-overview of system risk computation-designing impact analysis scheme- designing control analysis scheme-designing likelihood analysis scheme-system risk analysis-risk classification-risk rankings-individual system risk reviews-threat and vulnerability review-review activities for organizational risk-review audit findings-review of security incidents-review of security exceptions.
Module 6: Information Security Risk assessment and reporting
Risk analysis executive summary-methodology-results-risk register-Process summary-data collection-data analysis-risk analysis-reporting-key deliverables-scoping-executive interviews-document request-system profile-control survey-analysis-reporting-general process.

Reference Books:

1. Douglas Landoll, The Security Risk Assessment Handbook: A Complete Guide for Performing Security Risk Assessments, 2nd Edition,2011, ISBN-13: 978-1439821480 ISBN-10: 1439821488.
2. Mark Talabis and Jason Martin, Information Security Risk Assessment Toolkit: Practical Assessments through Data Collection and Data Analysis 1st Edition, ISBN-13: 978-1597497350, ISBN-10: 1597497355.
3. Evan Wheeler, Security Risk Management: Building an Information Security Risk Management Program from the Ground Up, 1st Edition, ISBN-13: 978-1597496155 ISBN-10: 1597496154.
4. Douglas J. Landoll, Information Security Policies, Procedures, and Standards: A Practitioner's Reference 1st Edition, ISBN-10: 1482245892, ISBN-13: 978-1482245899.

18CS3081	Security in Computing	L 3	T 0	P 0	C 3

Course Objectives:
Enable the student to
1. understand the security threats in computing
2. determine the necessary control measures to prevent the threats.
3. develop skills to design trusted operating systems.

Course Outcomes:
The student will be able to
1. identify the factors driving the need for security.
2. discuss security issues in operating systems
3. apply computer security in data and databases
4. analyze the possibilities in securing the network.
5. categorize information security techniques.
6. assess legal and ethical issues in security

Module 1: Introduction, Authentication, Access Control & Cryptography
Computer Security – Threats – Harm – Vulnerabilities – Control – Authentication - Access Control - Cryptography – Unintentional Programming Oversights – Malicious Code: Malware - Countermeasures
Module 2: Web Attacks & Operating Systems
Browser attacks – web attacks – Obtaining user/website data – Email Data – Security in Operating System - Security in the design of operating system
Module 3: Network Security
Network concepts - Threats to network communications - Wireless network security - Denial of service - Distributed denial-of-service - Cryptography in network security - Firewalls - Intrusion detection and prevention systems - Network management.
Module 4: Database Security
Introduction to Databases - Security requirements of databases - Reliability and integrity - Database disclosure - Data mining and big data.

Module 5: Information Security
Introduction to information security-components of information security – Approaches to information security implementation – Information security as art or science – Planning for security – Information Security Policy, Standards and Practices – Information Security blueprint – Implementing Information Security

Module 6: Legal Issues and Ethics
Protecting Programs and Data – Information and the law – Rights of Employees and Employers – Computer Crime – Ethical Issues in Computer Security – Incident Analysis with Ethics

Reference Books:

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, Fifth Edition, Pearson Education, 2015. ISBN-13: 978-0-13-408504-3.
2. Michael E. Whitman, Herbert J. Mattord, "Principles of Information Security", Fifth edition, Cengage Publication, 2016. ISBN: 9781285448367
3. William Stallings (Author), Lawrie Brown, "Computer Security: Principles and Practice", Pearson Publication, 4th Edition, ISBN-13: 978-0134794105.
4. William Stallings, "Cryptography and network security: Principles and practices", 7th Edition, Pearson Education, 2017. ISBN-13: 978-9332585225.
5. John Vacca, "Computer and Information Security Handbook", 3rd Edition, Morgan Kaufman, 2017, ISBN: 9780128038437

18CS3082	Sensor Networks and Internet of Things	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. understand the basic concepts of IoT and its applications.
2. analyze the different IoT technologies.
3. develop IoT projects.

Course Outcomes:
The student will be able to
1. identify the important aspects of IoT and its benefits.
2. illustrate the working principles of a IoT sensors and devices.
3. demonstrate the working of various tools available for IoT.
4. compare and contrast different technologies of IoT.
5. evaluate the performance of IoT technologies.
6. develop new IoT based projects.

Module 1: Introduction to the Internet of Things (IoT)
Introduction – Physical design of IoT – Logical design of IoT – IoT Enabling Technologies – IoT Levels and deployment templates – Domain specific IoT: Introduction – Home automation – Cities – Environment – Energy – Retail – Logistics – Agriculture – Industry – Health and Style.

Module 2: IoT Sensors and Devices
IoT and M2M: Introduction – M2M – difference between IoT and M2M – SDN and NFV of IoT – IoT Device – Raspberry Pi – About the board – Linux on Raspberry Pi – Raspberry Pi Interfaces – other IoT Devices - Smart objects: The things in IoT – Sensors, Actuators and Smart objects – Sensor Networks.

Module 3: IoT Networks and Protocols
IP as the IoT Network layer: The need for optimization - Optimizing IP for IoT – Application protocol for IoT: The transport layer – IoT application transport methods – SCADA – Generic web-based protocols – IoT Application layer protocols – CoAP – Message Queuing Telemetry Transport (MQTT).

Module 4: IoT and Big Data
Data Analytics for IoT: Introduction – Apache Hadoop – Using Hadoop MapReduce for Batch Data Analysis – Apache Oozie – Apache Spark – Apache Storm – Using Apache for Real Time Data Analysis

– Machine Learning – Big Data Analytics Tools and Technology – Edge Streaming Analytics – Network Analytics.

Module 5: Security in IoT

A brief history of OT – Common challenges in OT security – How IT and OT security practices and system vary – Formal Risk Analysis structure: OCTAVE and FAIR – The phased application of security in Operational Environment.

Module 6: Creating the IoT Project

IoT Systems: Logical design using Python – Installing Python – Python package of Interest of IoT - Programming Raspberry Pi with Python – Python web application Framework: Django – Designing a RESTful web API – Amazon web services for IoT – Tools for IoT: Chef – Chef case studies – Puppet – Puppet case study.

Reference Books:

1. Arshdeep Bahga and Vijay K. Madisetti, Internet of Things: A Hands- on Approach, 2014, ISBN: 978-0996025515.
2. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, Cisco Press, 2017, ISBN: 9781587144561.
3. Peter Waher, Learning Internet of Things,PACKT publication,2015,ISBN:978-1-78355-353-2.
4. Rajkumar Buyya, Amir Vahid Dastjerdi, Internet of Things Principles and Paradigms, Elsevier, 2016, ISBN: 978-0-12-805395-9.

18CS3083	Sensors and Internet of Things Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. understand the building blocks of internet of things and its characteristics.
2. familiarize with the programming aspects of iot.
3. gain knowledge on interfacing iot with communication module, cloud and analytics.

Course Outcomes:

The students will be able to

1. select the sensors suitable for iot applications.
2. extend the captured data by connecting the communication module.
3. apply suitable database to capture the sensed iot data.
4. analyze the data using cloud.
5. relate the iot module for real world problems.
6. develop a fog environment using iot controllers.

List of Experiments

1. Introduction to Arduino IDE
2. Interfacing sensors to Arduino Board
3. Connecting Arduino with communication module
4. Introduction to Python Programming
5. Interfacing sensors with Raspberry Pi.
6. Interfacing display units with controllers.
7. Interfacing controller and Cloud.
8. Analysis of IoT Test beds
9. Storing IoT Data in Google Firebase.
10. Creation of a Fog environment using controllers.

18CS3084	Smart Sensors and Internet of Things	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand the application areas of IoT
2. realize the revolution of internet in mobile devices, cloud & sensor networks
3. recognize the building blocks of internet of things and characteristics

Course Outcomes:

The student will be able to

1. understand the vision of IoT from a global context.
2. determine the market perspective of IoT.
3. use of devices, gateways and data management in IoT.
4. application of IoT in industrial and commercial building automation and real world design constraints.
5. building state of the art architecture in IoT.

Module 1: Environmental Parameters Measurement and Monitoring

Why measurement and monitoring are important, effects of adverse parameters for the living being for IoT

Module 2: **Sensors**

Working Principles: Different types; Selection of Sensors for Practical Applications Introduction of Different Types of Sensors such as Capacitive, Resistive, Surface Acoustic Wave for Temperature, Pressure, Humidity, Toxic Gas etc

Module 3: Important Characteristics of Sensors

Determination of the Characteristics Fractional order element: Constant Phase Impedance for sensing applications such as humidity, water quality, milk quality Impedance Spectroscopy: Equivalent circuit of Sensors and Modelling of Sensors Importance and Adoption of Smart Sensors

Module 4: Architecture of Smart Sensors

Important components, their features Fabrication of Sensor and Smart Sensor: Electrode fabrication: Screen printing, Photolithography, Electroplating Sensing film deposition: Physical and chemical Vapor, Anodization, Sol-gel

Module 5: Interface Electronic Circuit for Smart Sensors

Interface Electronic Circuit for Smart Sensors and Challenges for Interfacing the Smart Sensor, Usefulness of Silicon Technology in Smart Sensor And Future scope of research in smart sensor

Module 6: Recent Trends

Recent trends in smart sensor for day to day life, evolving sensors and their architecture.

Reference Book:

1. Yasuura, H., Kyung, C.-M., Liu, Y., Lin, Y.-L., Smart Sensors at the IoT Frontier, 2018, Springer
2. Chong-Min Kyung, Smart Sensors and Systems: Innovations for Medical, Environmental, and Iot Applications, 2018, Springer, ISBN-10: 3319814524, 978-3319814520

18CS3085	Soft Computing	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques and hybrid systems.
2. gain thorough understanding of the theoretical and practical aspects of soft computing.
3. identify relevant technique and tool to solve the real-world applications.

Course Outcomes:

The student will be able to

1. describe the principles of biological systems and the concept of learning through soft computing techniques
2. summarize the theoretical and practical aspects of different soft computing and hybrid techniques.
3. demonstrate the steps involved in the development of intelligent system.
4. analyze the problem thoroughly and identify the appropriate technique to design the model
5. design and implement the computing systems using appropriate technique and tools for any real world application.
6. evaluate and compare the performance of different soft computing approaches for a given problem.

Module 1: Introduction

Evolution of Computing: Soft Computing Constituents, From Conventional AI to Computational Intelligence, Hybrid Systems.

Module 2: Artificial Neural Networks

Basic Concepts, Learning Laws, Single Layer Perceptron, Multiple Layer Perceptron, Radial Basis Function, Hopfield Network, Associative Memory, Kohonen Self Organizing Networks, Learning Vector Quantization, Adaptive Resonance Theory, Applications.

Module 3: Fuzzy Logic

Introduction, Fuzzy Sets, Operations on Fuzzy Sets, Fuzzy Relations, Membership Functions: Fuzzy Rules and Fuzzy Reasoning, Fuzzy Inference Systems, Fuzzy Expert Systems, Fuzzy Decision Making.

Module 4: Optimization Algorithms

Introduction to Single-objective Optimization, Objective Function, Genetic Algorithm, Particle Swarm Optimization, Introduction to Multi-objective Optimization.

Module 5: Hybrid Systems

Introduction, Integration of Soft Computing Techniques, Neuro-Genetic Systems, Neuro-Fuzzy Systems, ANFIS Architecture, Fuzzy-Genetic Systems, Recent trends.

Module 6: Advanced Topics and Frameworks

Introduction to Deep Learning, Convolutional Neural Network, Recurrent Neural Networks, Applications, State-of-the-art development Frameworks, Toolboxes and Software Libraries for Soft Computing task realization.

Reference Books:

1. S. Rajasekaran and G.A.Vijayalakshmi Pai, “Neural Networks, Fuzzy Logic and Evolutionary Algorithms : Synthesis and Applications”, 2nd Revised edition edition, PHI, 2017, ISBN-10: 812035334X, ISBN-13: 978-8120353343
2. S.N.Sivanandam and S.N.Deepa, “Principles of Soft Computing”, 2nd edition, Wiley India Pvt Ltd, 2011, ISBN-10: 8126527412, ISBN-13: 978-8126527410.
3. Xin-She Yang, “Nature-Inspired Optimization Algorithms”, 1st edition, Elsevier Inc, 2014, ISBN-10: 0124167438, ISBN-13: 978-0124167438.
4. J.S.R.Jang, C.T.Sun and E.Mizutani, “Neuro-Fuzzy and Soft Computing - A Computational Approach to Learning and Machine Intelligence”, PHI/Pearson Education 2004, ISBN: 0-13-261066-3.
5. Samir Roy and Udit Chakraborty, “Introduction to Soft Computing - Neuro-Fuzzy and Genetic Algorithms”, Pearson, 2013, ISBN:978-81-317-9246-9.
6. James A. Freeman, David M.Skapura, “Neural Networks Algorithms, Applications and Programming Techniques”, Pearson, 2007, ISBN:978-81-317-0808-8.
7. Laurene Fausett, “Fundamentals of Neural Networks - Architectures, Algorithms and Applications”, Pearson, 2013, ISBN:978-81-317-0053-2.
8. David E. Goldberg, “Genetic Algorithm in Search Optimization and Machine Learning” Pearson Education India, 2013, ISBN-13: 978-0201157673

18CS3086	Soft Computing Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. apply the knowledge gained on theoretical and practical aspects of soft computing techniques and hybrid systems.
2. identify the relevant technique and tool to solve the real-world applications.
3. design, implement and evaluate the model output using different performance metrics

Course Outcomes:

The student will be able to

1. relate the knowledge gained with real world problems to propose solutions.
2. choose the relevant framework and toolbox to implement the different soft computing and hybrid techniques.
3. build an intelligent system using appropriate technique with suitable pre and post processing modules
4. design and implement the systems using appropriate technique
5. evaluate and recommend the best technique for real-world scenario.
6. combine different soft computing techniques to deliver best solution.

List of Experiments

1. Write a program to identify a discriminative function for any dataset using linear regression models
2. Write a program to implement logic gates using single layer perceptron algorithm
3. Write a program to classify the input dataset using Multiple Layer Perceptron (MLP) trained using Back Propagation Algorithm (BPA)
4. Write a program to demonstrate clustering approach using Kohonen's Self Organizing Map (SOM)
5. Write a program to implement various primitive operations on fuzzy sets
6. Write a program to implement various defuzzification techniques
7. Write a program to implement a simple fuzzy inference system using Sugeno-type approach
8. Write a program to implement a simple fuzzy inference system using Mamdani-type approach
9. Write a program to find the shortest path using Genetic Algorithm (GA)
10. Write a program for travelling salesman problem using Particle Swarm Optimization (PSO) optimization technique
11. Write a program for any application on classification and prediction using Adaptive Neuro-Fuzzy Inference System (ANFIS)
12. Write an optimization algorithm to train a neural network.

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS3087	Steganography and Digital Watermarking	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. provide a insight to steganography techniques and digital watermarking
2. identify attacks on data hiding
3. appraise the integrity of data

Course Outcomes:

The student will be able to

1. understand principles of data hiding, and the difference between steganography and watermarking
2. apply the concept of information hiding.

3. summarize current techniques of steganography and learn how to detect and extract hidden information.
4. learn watermarking techniques and through examples understand the concept
5. analysis mathematical limits of watermarking
6. classify different attacks on digital watermarking and benchmarks used

Module 1: Steganography
Overview, History, Methods for hiding (text, images, audio, video, speech etc.), Issues: Security, Capacity and Imperceptibility, Steganalysis: Active and Malicious Attackers, Active and passive steganalysis

Module 2: Frameworks for Secret Communication
Pure Steganography, secret key, public key steganography), Steganography algorithms (adaptive and non-adaptive),

Module 3: Steganography techniques
Substitution systems, Spatial Domain, Transform domain techniques, Spread spectrum, Statistical steganography, Cover Generation and cover selection, Tools: EzStego, FFEncode, Hide 4 PGP, Hide and Seek, S Tools etc.)

Module 4: Detection, Distortion, Techniques
LSB Embedding, LSB Steganalysis using primary sets, Texture based

Module 5: Digital Watermarking
Introduction, Difference between Watermarking and Steganography, History, Classification (Characteristics and Applications), Types and techniques (Spatial-domain, Frequency-domain, and Vector quantization based watermarking), Attacks and Tools (Attacks by Filtering, Remodulation, Distortion, Geometric Compression, Linear Compression etc.), Watermark security & authentication.

Module 6: Recent Trends
Recent Trends in Steganography and digital watermarking techniques. Case study of LSB Embedding, LSB Steganalysis using primary sets.

Reference Books:

1. Peter Wayner, "Disappearing Cryptography–Information Hiding: Steganography & watermarking", Morgan Kaufmann; 3 edition (18 December 2008) ISBN-10: 0123744792, ISBN-13: 978-0123744791
2. Ingemar J. Cox, Matthew L. Miller, Jeffrey A. Bloom, Jessica Fridrich, Ton Kalker, "Digital Watermarking and Steganography" Morgan Kauffman Publishers, 13th November 2007 eBook ISBN: 9780080555805 Hardcover ISBN: 9780123725851
3. Information Hiding Techniques for Steganography and Digital Watermarking by Stefan Katzenbeisser, Fabien A.P. Petitcolas.
4. Information Hiding: Steganography and Watermarking-Attacks and Countermeasures by Neil F. Johnson,ZoranDuric, SushilJajodia
5. M. Barni, F Bartolini, "Watermarking Systems Engineering: Enabling Digital Assets Security and Other Applications", Marcel Dekker, 2004, ISBN-0824748069

18CS3088	Storage Area Networks	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. understand storage networking properties, benefits, architectural concepts and technologies.
2. apply different software components for storage area networks.
3. develop and manage strategies for SAN deployment.

Course Outcomes:
The student will be able to
1. define the storage fundamentals

2. describe the components and uses of a Storage Area Networks (SAN)
3. choose SAN applications for a given network
4. categorize storage networking issues
5. set up customized SAN for their network
6. appraise the SAN network

Module 1: Introduction to storage area networks
Understanding Storage Networking - Benefits - Data Center Evolution - Killer Apps for SANs.
Module 2: Storage Networks and Architecture
Storage networking architecture - A path from data to application - Network Storage systems - Storage in Storage Networking - Challenges - The cost of online storage –Making SAN storage to perform - Keeping SAN up and working - The Network in Storage Networking.
Module 3: Basic Software for Storage Networking
Software for SAN - Shared access data managers - Computer system IO performance - Volumes - Resilience - Performance and flexibility –File Systems and Application performance. 2017 Computer Sciences Technology
Module 4: Advanced Software for SAN
Data Replication types - Using data replication - Cluster data models – Enterprise backup software for SAN - Backup management –Enterprise backup architecture - Policies - Minimizing the impact of backup - LAN free and server less backup.
Module 5: SAN implementation and Management strategies
Adopting Storage Networking–Steps to successful SAN deployment - Adoption alternatives - Managing SANs– Ideal management - Management and backup impact - Management standards - Challenges.
Module 6: Software component of SAN
The switch's Operating system, Device Drivers, The Supporting the switch's components, Configuration options for SANs. Planning for business continuity.

Reference Books:

1. Paul Massiglia Richard Barker, Storage Area Network Essentials: A Complete Guide to Understanding and Implementing SANS, Wiley India Pvt Ltd, 2011, ISBN: 978-0-471-03445-2
2. Robert Spalding, Storage Networks: The Complete Reference 1st Edition, Tata McGraw-Hill Education, Sixth reprint 2008, ISBN 13: 9780070532922
3. EMC Education Services, Information Storage and Management: Storing, Managing and Protecting Digital Information, Wiley India Pvt Ltd, 2011, ISBN 978-0-470-61833-2
4. Ulf Troppen, Rainer Erkens and Wolfgang Muller, Storage Networks Explained: Basics and Application of Fiber Channel SAN, NAS ISCSI and Infini Band, Wiley India Pvt Ltd, 2012, ISBN: 978-0-470-86183-7

18CS3089	Storage Technologies and Networks	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. understand storage networking technologies such as FC-SAN, NAS, IP-SAN and data archival solution – CAS
2. define information security, and storage security domains
3. analyze logical and physical components of a storage infrastructure including storage subsystems

Course Outcomes:
The student will be able to
1. describe the different storage networking technologies
2. discuss different storage virtualization technologies and storage security domains
3. relate the different fibre channel ports.
4. identify the various components of a storage system environment

5. design business continuity solutions including recovery technologies and remote replication solutions.
6. interpret the physical and logical components of a storage infrastructure along with the parameters of managing and monitoring elements.

Module 1: Storage System

Information Storage - Evolution of Storage Technology and Architecture - Data Centre Infrastructure – Virtualization and Cloud Computing – Application – Database Management System – Host – Connectivity – Storage - Disk Drive Components - Disk Drive Performance – Host Access to Data – Direct–Attached Storage – Storage Design based on Application – Disk Native Command Queuing – Introduction to Flash Drives - RAID Implementation of RAID - RAID Array Components - RAID Techniques – RAID Levels - RAID Impact on Disk Performance - RAID Comparison - Hot Spares.

Module 2: Storage Networking Technologies

Components of an Intelligent Storage System – Storage Provisioning - Types of Intelligent Storage Systems - Fibre Channel Overview - The SAN and its Evolution - Components of FC SAN - FC Connectivity – Switched Fabric Ports - Fibre Channel Architecture – Fabric Services – Switched Fabric Login Types - Zoning - FC SAN Topologies – Virtualization in SAN.

Module 3: Network Attached Storage and Content Addressed Storage

iSCSI – FCIP – FCoE - General Purpose Servers vs NAS Devices - Benefits of NAS - File Systems and Network File Sharing NAS - Components of NAS – NAS I/O Operation - NAS Implementations - NAS File Sharing Protocols - Factors affecting NAS Performance – File Level Virtualization – Object Oriented Storage Devices - Content Addressed Storage – CAS Use Cases – Unified Storage.

Module 4: Business Continuity and Backup

Information Availability - BC Terminology - BC Planning Life Cycle - Failure Analysis - Business Impact Analysis - BC Technology Solutions - Backup Purpose - Backup Considerations - Backup Granularity - Recovery Considerations - Backup Methods – Backup Architecture - Backup and Restore Operations - Backup Topologies - Backup in NAS Environments – Backup Targets – Data Deduplication for Backup – Backup in Virtualization Environments – Data Archive.

Module 5: Local and Remote Replication

Replication Terminology - Uses of Local Replicas - Replica Consistency - Local Replication Technologies - Tracking Changes to Source and Replica -Restore and Restart Considerations - Creating Multiple Replicas – Local Replication in a Virtualized Environment - Modes of Remote Replication - Remote Replication Technologies – Three-Site Replication – Data Migration Solutions – Remote Replication and Migration in a Virtualized Environment.

Module 6: Storage Security and Management

Information Security Framework - Risk Triad - Storage Security Domains - Security Implementations in Storage Networking – Securing Storage Infrastructure in Virtualized and Cloud Environments - Monitoring the Storage Infrastructure – Storage Infrastructure Management Activities –Storage Infrastructure Management Challenges - Developing an Ideal Solution – Information Life Cycle Management – Storage Tiering.

Reference Books:

1. EMC Corporation, "Information Storage and Management: Storing, Managing and Protecting Digital Information in Classic, Virtualized and Cloud Computing Environments", 2nd Edition, Wiley Publishing Inc. USA, 2014, ISBN 978-81-265-3750-1.
2. EMC Corporation, Information Storage and Management, Wiley Publishing Inc. USA, 2009, ISBN 978-81-265-2147-0.
3. Tom Clark, Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs, 2nd Edition, Addison Wesley, 2003, ISBN 978-0321136503.
4. Robert Spalding, "Storage Networks: The Complete Reference", Tata McGraw Hill, 2008, ISBN 978-0-07- 053292.
5. Meeta Gupta, "Storage Area Network Fundamentals", Cisco Press, 2002, ISBN 1-58705- 065.

18CS3090	Threaded and Message-Passing Programming	L 3	T 0	P 0	C 3

Course Objectives:

Enable the student to

1. be familiar with the common attributes and design concerns of message-passing systems
2. evaluate the suitability of different message-passing approaches for a particular application
3. understand the benefits and costs of formal verification of a concurrent system, and the situations in which it is appropriate

Course Outcomes:

The student will be able to

1. design MPI for distributed applications.
2. familiarize themselves rapidly with new programming languages.
3. design multi-core and distributed applications using several modern message passing programming paradigms
4. have experience of implementing multi-core and distributed applications using a variety of message-passing systems.
5. familiarize themselves rapidly with new programming languages.

Module 1: Introduction to MPI, Topologies, Remote Memory Access, Dynamic Process Management
Module 2: Parallel I/O, Non-contiguous Accesses, Collective I/O, Arrays, Distributed Arrays, Non-blocking I/O, Split Collective I/O, Shared File Pointers, Consistency Semantics, File Interoperability.
Module 3: Synchronization, Remote Memory Operations.
Module 4: Dynamic Process Management: Creating and Connecting MPI Processes, Design of the MPI Dynamic Process Routines.
Module 5: Thread, Thread Safety, Mixed-Model Programming: MPI for SMP Clusters, Decoding Data types, Generalized Requests, Adding New Error Codes and Classes, Attribute Caching, Error Handling.
Module 6: Case study of Remote Memory Access, Dynamic Process Management and Mixed-Model Programming.

Reference Books:

1. William Gropp Ewing Lusk Rajeev Thakur, Using MPI-2: Advanced Features of the Message-Passing Interface, 2000, MIT Press.
2. Richard H. Carver Kuo-Chung Tai, "Message Passing", 2005, Wiley.
3. Adamo, Jean-Marc, "Multi-Threaded Object-Oriented MPI-Based Message Passing Interface" 1998, The ARCH Library, Springer

18CS3091	Web Analytics and Development	L 3	T 0	P 0	C 3

Course Objectives:

Enable the student to

1. understand to the basic concepts of social network analysis.
2. apply analysis methods to a variety of social media.
3. use the best practices for data analytics to manipulate a company's conversion funnel and customer retention rate.

Course Outcomes:

The student will be able to

1. recognize the key tools and strategies associated with web analytics.
2. select free open source web analytics tools to collect, identify information and data
3. test the algorithms to optimize navigation and identify potential revenue sources using web analytics.
4. demonstrate the link between qualitative and quantitative methods of social network analysis

5. devise effective web analytics strategies for e-commerce, business, and marketing solutions
6. attach with core research communities, publications, focused on web and social media
7. analytics and research questions engaged in.

Module 1: Introduction
Social network and Web data and methods, Graph and Matrices, Basic measures for individuals and networks, Information Visualization
Module 2: Web Analytics tools
Click Stream Analysis, A/B testing, Online Surveys
Module 3: Web Search and Retrieval
Search Engine Optimization, Web Crawling and indexing, Ranking Algorithms, Web traffic models.
Module 4: Making Connection
Link Analysis, Random Graphs and Network evolution, Social Connects: Affiliation and identity
Module 5: Connection
Connection Search, Collapse, Robustness Social involvements and diffusion of innovation.
Module 6: Case studies
Email: The Lifeblood of Modern Communication - Thread Networks: Mapping Message Boards and Email Lists - Twitter: Conversation, Entertainment, and Information - Visualizing and Interpreting Facebook Networks

Reference Books:

1. Hansen, Derek, Ben Sheiderman, Marc Smith. 2011. Analyzing Social Media Networks with NodeXL : Insights from a Connected World. Morgan Kaufmann, 304.
2. Easley, D. & Kleinberg, J. (2010). Networks, Crowds, and Markets: Reasoning About a Highly Connected World. New York: Cambridge University Press.
3. Avinash Kaushik. 2009. Web Analytics 2.0: The Art of Online Accountability.
4. Wasserman, S. & Faust, K. (1994). Social network analysis: Methods and applications. New York: Cambridge University Press. Monge, P. R. & Contractor, N. S. (2003). Theories of communication networks. New York: Oxford University Press.

18CS3092	Web Application Security	L	T	P	C
		3	0	0	3

Course Objectives:
Enables the students to
1. have insight on web application security, its importance and vulnerability in the industry
2. explore the most common threats against web applications and advanced web exploitation techniques
3. examine Web Application Security (WAS) scanners and testing methods to conduct web application risk assessment and penetration testing.

Course Outcomes:
The student will be able to
1. understand essentials of web applications ,its history, benefits, drawbacks, future and its associated security risks
2. recognize the vulnerabilities of web applications.
3. have clear understanding of the flaws, myths and best practices for WAS.
4. develop and design a secure web application
5. exploit the attacks on real world web applications
6. apprehend, develop, acquire, operate, and maintain applications that can be trusted

Module 1: Web Application Security Fundamentals
Introduction to web application security, The OWASP Top -10 vulnerabilities, Security Fundamentals , Authentication Fundamentals, two-factor and three-factor authentication, Web application authentication,

Secure authentication and best practices, Authorization, Access control continued, session management fundamentals, securing web application session management.

Module 2: Web Application Security Principles

Browser security principles, same origin policies, exceptions, cross site scripting, cross site request forgery, File security principles, keeping source code secret, security through obscurity, forceful browsing, and directory traversal.

Module 3: Secure Development & Deployment

Secure development methodologies, banking security, Holistic approach to application security, Industry standard secure development methodologies and maturity models.

Module 4: Mobile Application Security

IoT security – OWASP Top 10, Mobile device security – Introduction, attack vector and models, hardware centric security aspects, SMS / MMS vulnerabilities, software centric security aspects, mobile web browser security

Module 5: Programming Security

Security design principles, Secure Programming, Worms and Other Malware, Buffer Overflows, Client State Manipulation, SQL Injection, Password Security, Cross Domain Security in Web Applications, Attack Patterns, Preventing XSRF, Preventing XSSI, Preventing XSS

Module 6: Web Server Security

Isolation of Web server, Configuration of the Web server ,Identify and enable web-server-specific logging mechanisms, security implications for your Web server ,Configuring web server to minimize the functionality of programs, scripts, and plug-ins. Configuring web server to use authentication and encryption technologies, Maintain the authoritative copy of your Web site content on a secure host, Protecting Web server against attacks.

Reference Books:

1. Bryan and Vincent, "Web Application Security, A Beginners Guide",2012, McGraw-Hill, ISBN 978-1259005466
2. Neil Daswani, Chirstopher Kern & Anita Kesavan, "Foundations of Security: What Every Programmer Needs to Know" Frist Edition, 2007, Apress , ISBN978-1590597842
3. Dafydd Stuttard, Marcus Pinto, "The Web Application Hacker's Handbook: Discovering and Exploiting Security Flaws", 2008, Weily Publishers, ISBN: 90470237984.
4. Prakhar Prasad, "Mastering Modern Web Penetration Testing", 2016 , Packt Publishing Limited, ISBN: 978-1785284588
5. Simpson Garfinkel, Gene Spafford, "Web Security, Privacy and Commerce", Second Edition, 2002, O'Reilly, ISBN: 978-0-596-00045-5
6. Joel Scambray, Mike Shema, Caleb Sima, "Hacking Exposed Web Applications", Third Edition 2010, McGraw Hill Education, 978-0071074407
7. Klaus Peter Kossakowski, Julia Allen, "Securing Public Web Servers" *2000* Carnegie Mellon University, SEI reports.

18CS3093	Web Search and Information Retrieval	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. explain the various aspects of an Information retrieval system and its evaluation and to be able to design such a system from scratch.
2. describe about advanced techniques for text-based information retrieval and Web search.
3. analyze and retrieve relevant pieces of information from large text collections of the Web applications.

Course Outcomes:

The student will be able to

1. interpret the basics of information models.

2. illustrate the different techniques like tokenizing and indexing used in information retrieval systems.
3. evaluate the concept of query operations and languages.
4. simulate the various text classification and clustering techniques.
5. experiment the various concepts of web search.
6. appraise the different tools of search engines.

Module 1: Basic IR Model

Boolean Retrieval: Example Information Retrieval Problem, Processing Boolean Queries, Extended Boolean Model verses Ranked Retrieval -Vocabulary and Postings-Dictionaries and Tolerant Retrieval: Search Structures for Dictionaries, Wildcard Queries, Spelling Correction, phonic Correction-Index Construction: Hardware Basics, Blocked Sort-based Indexing, Single-pass in-memory Indexing, Distributed Indexing, Dynamic Indexing.

Module 2: Tokenizing, Indexing and Implementation of Vector Space Retrieval

Index Compression: Statistical properties of terms, Dictionary compression, Posting File Compression-Posting File Compression-Scoring, term weighting and the Vector Space Model: Parametric and Zone Indexes, Frequency and Weighting, Vector Space Model for Scoring-Computing Scores in a complete search system-Evaluation in information Retrieval.

Module 3: Query operations and Languages

Relevance Feedback and Query Expansion-XML retrieval: Basic XML concepts, challenges in XML retrieval, Vector Space Model for XML Retrieval, Text-Centric verses Data-Centric XML Retrieval-Evaluation of XML Retrieval-Probabilistic Information Retrieval- Language Models for Information Retrieval.

Module 4: Text classification and Clustering

Text Classification and Naive Bayes-Vector Space Classification-Support Vector Machine learning on documents-Flat Clustering- Hierarchical Clustering-Matrix Decompositions and Latent Semantic indexing.

Module 5: Web Search

Web Search Basics: Web characteristics, Advertising as the Economic Model, the Search User Experience, Index size and Estimation, Near-Duplicate and Shingling-Web Crawling indexes: Crawling, Distributing Indexes, Connectivity Servers-Link Analysis.

Module 6: Search Engines

Search Engines and Information Retrieval- Architecture of a Search Engine- Crawls and Feeds-Evaluating Search Engines: Effectiveness Metrics, Efficiency Metrics, Training, Testing, and Statistics – Social Search.

Reference Books:

1. Christopher D. Manning, Prabhakar Raghavan, Hinrich Schütze, "Introduction to Information Retrieval, Cambridge University Press, 1st Edition, 2008, ISBN-13: 978-0521865715.
2. Croft, D. Metzler, T. Strohman, "Search Engines: Information Retrieval in Practice", Addison-Wesley, 1st Edition, 2009, ISBN-13: 978-0136072249.
3. R. Baeza-Yates, B. Ribeiro-Neto, "Modern Information Retrieval", Addison-Wesley, 2nd Edition, 2011, ISBN-13: 978-0321416919.
4. Stefan Büttcher, Charles L. A. Clarke , Gordon V. Cormack," Information Retrieval: Implementing and Evaluating Search Engines, MIT Press, Kindle Edition, 2010, ISBN: 979-0-262-02651-2.

18CS3094	Wireless Access Technologies	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the Student to

1. understand the current and emerging wired and wireless access technologies.

2. gain an overview of wireless access technologies, Fixed wireless access networks, terminal mobility issues regarding wireless access to Internet.
3. get an insight of Wireless networking security issues, Wireless access network exploitation and management, software requirements, link quality control.

Course Outcomes:

The student will be able to

1. interpret basic terms and characteristics of wireless access networks
2. compare various wireless access technologies
3. analyze measurements of wireless access network parameter
4. assess security issues in wireless networks
5. choose modulation technique for wireless transmission
6. describe and explain wireless access standards and PC wireless interface feature for wireless technologies.

Module 1: Introduction

Necessity for wireless terminals connectivity and networking. Wireless networking advantages and disadvantages, Overview of wireless access technologies. Narrowband and broadband networks, fixed and nomadic networks. Wireless local loop (WLL), Public Switched Telephone Network (PSTN) interfaces.

Module 2: Fixed wireless access (FWA) networks

Fixed wireless access (FWA) networks, frequency bands for different networks. Criterions for frequency bands allocation, Network topologies, hotspot networks. Communication links: point-to-point (PTP), point to- multipoint (PMP), multipoint-to-multipoint (MTM).

Module 3: Standards used for Wireless Access Networks

Standards for most frequently used wireless access networks: WPAN (802.15, Bluetooth, DECT, IrDA), UWB (Ultra-Wideband), WLAN (802.11, Wi-Fi, HIPERLAN, IrDA), WMAN (802.16, WiMAX, HIPERMAN, HIPERACCESS), WWAN (802.20), Other technologies for broadband wireless access, Local Multipoint Distribution Service (LMDS), Multichannel Multipoint Distribution Service (MMDS). Ad Hoc networks, Network services. Services types based on carrier frequency and bandwidth.

Module 4: Models and Features

Wireless access networks planning, design and installation. Services provision, legislative and technical aspects, Technical and economical factors for network planning: expenses, coverage, link capacity, network complexity and carrier-to-interference ratio (C/I). Base station or access point allocation. Base station and access point equipment. Terminal mobility issues regarding wireless access to Internet. Wireless networking security issues.

Module 5: PC Wireless Interface Example of laptop or handheld PC wireless connection in real environment. PC wireless interface equipment. Wireless access network exploitation and management, software requirements, link quality control. Business model, wireless network services market, market research and marketing, service providers, wireless data application service providers (WDASP) and their role on public telecommunication services market, billing systems.

Module 6: Recent Trends in Wireless networking

Recent trends in wireless networking and various access mechanism, new standards of wireless communication.

Reference Books:

1. M. P. Clark, Wireless Access Networks: Fixed Wireless Access and WLL networks -- Design and Operation, John Wiley & Sons, Chichester
2. D. H. Morais, Fixed Broadband Wireless Communications: Principles and Practical Applications, Prentice Hall, Upper Saddle River
3. R. Pandya, Introduction to WLLs: Application and Deployment for Fixed and Broadband Services, IEEE Press, Piscataway.

4. Savo G Glisic," Advanced Wireless Networks- Technology and Business models", Wiley, 3rd edition- 2016.

18CS3095	Wireless and Mobile Networks	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. recognize the wireless/mobile market and the future needs and challenges.
2. design and analyze various medium access control protocols.
3. classify the MAC and network protocols using network simulation software tools.

Course Outcomes:

The student will be able to

1. identify the various types of wireless networks, standards, operations and use cases.
2. design wlan, wpan, wwan, cellular based upon underlying propagation and performance analysis.
3. demonstrate knowledge of protocols used in wireless networks and learn simulating wireless networks.
4. compare the trade-offs between wired and wireless links.
5. develop mobile applications to solve some of the real world problems.
6. design wireless networks

Module 1: Introduction

Wireless Networking Applications, Reference model, Multiple Access Technologies - CDMA, FDMA, TDMA, Spread Spectrum technologies, Frequency reuse, Radio Propagation and Modelling - IEEE 802.11 Wireless LANs Physical & MAC layer, 802.11 MAC Modes (DCF & PCF) IEEE 802.11 standards, Architecture & protocols, Infrastructure vs. Adhoc Modes, Hidden Node & Exposed Terminal Problem, Problems, Fading Effects in Indoor and outdoor WLANs, WLAN Deployment issues

Module 2: Wireless Cellular Networks

1G and 2G, 2.5G, 3G, and 4G, Mobile IPv4, Mobile IPv6, TCP over Wireless Networks, Cellular architecture, Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Improving coverage and capacity in cellular systems, Spread spectrum Technologies.

Module 3: WMAN, WRAN AND WSN

WiMAX (Physical layer, Media access control, Mobility and Networking), IEEE 802.22 - Wireless Regional Area Networks, IEEE 802.21 Media Independent Handover Wireless Sensor Networks - Overview Introduction, Application, Physical, MAC layer and Network Layer, Power Management, Tiny OS Overview.

Module 4: Wireless PANs And Mobile Networks Applications Bluetooth and IEEE 802.15 - Cellular Wireless Network -Mobile Applications and Mobile IP - Long - Range Communications

Module 5: Mobility Management

Mobility management – Hand off management – GSM – Signaling, Management, Mobility management – GPRS – Wireless Application Protocol.

Module 6: Advanced Topics

Wireless Enterprise Networks - IEEE 802.11x and IEEE 802.11i standards, Introduction to Vehicular Adhoc Networks.

Reference Books:

1. Schiller J., Mobile Communications, Addison Wesley ,2nd edition, 2003, ISBN-13: 978-8131724262 , ISBN-10: 8131724263.
2. Yi Bing Lin and Imrich Chlamtac, Wireless and Mobile Network Architectures, John Wiley and Sons Inc., Third edition, 2008, ISBN: 9788126515608, 8126515600.
3. Stallings W., Wireless Communications and Networks, 2nd edition, Pearson Education 2005
4. Stojmenic Ivan, Handbook of Wireless Networks and Mobile Computing, John Wiley and Sons. Inc 2002.

5. Pandya Raj, Mobile and Personal Communications Systems and Services, John Wiley & Sons, 2004.

18CS3096	Wireless LAN	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student

1. To understand the basics of Wireless LAN
2. To acquire understanding on various IEEE standards
3. To understand the cryptographic concepts involved in networking

Course Outcomes:

The student will be able to

1. define the terminologies in wireless LAN
2. describe the frame structures
3. illustrate the management operations
4. explain the hardware components
5. analyze the performance of the communication channel
6. comprehend the cryptography concepts.

Module 1: Introduction to Wireless LAN

Introduction to WLAN terminology and overview of WLAN**:** Wireless Challenges, IEEE Standards, IEEE 802 family, 802.11 LANs, AP, BSS, IBSS, ESS, DS,SSID, BSSID, Mobility, Security.

Module 2: Features of Wireless LAN

802.11 MAC: CSMA/CA, Hidden & Exposed Node Problems, MAC Access Modes, NAV, Inter frame Spacing, Fragmentation, MAC Frames - 802.11 MAC frame, Data Frames, Control Frames, Management Frames, RTS/CTS, Structure of Management Frames, Management Frame Components.

Module 3: Management Operations

Management Architecture, Scanning, Authentication, Pre authentication, Association, Power Conservation, Timer Synchronization, Spectrum Management.

Module 4: Hardware Overview

Network Interface card, Access point hardware, chipsets, 802.11 a/b/g PHY - Physical-Layer, Architecture, The Radio Link, FHSS, DSSS, OFDM, QAM, ERP;

Module 5: Wireless LAN Standards

802.11n: MIMO, Beam Forming, Channel Bonding, Block ACK, 802.11e QoS / WMM, 802.11s Mesh network, 802.11ac, 802.11ad, Performance Analysis, Mathematical Modeling and Analysis.

Module 6: Cryptography Concepts

PRF/PRP, Stream / Block Cyphers, RC4, 3DES, AES, Hashing, Asymmetric key pairs, Certificates, WLAN Security: WEP, TKIP, AES-CCMP, RADIUS, TLS, TLS over EAP, Kerberos, LEAP, PEAP, EAP-SIM, Network & Security Architecture, Network Planning & Analysis.

Reference Books:

1. Matthew S. Gast, "802.11 Wireless Networks: The Definitive Guide", 3rd Revised edition edition, O'Reilly Media, 2017, ISBN-10: 1491963549.
2. Matthew S. Gast, “802.11n: A Survival Guide”, Shroff / O'Reilly, 2012, ISBN: 1449312047.
3. Matthew S. Gast, “802.11ac: A Survival Guide”, Shroff / O'Reilly, 2013, ISBN: 9351102432.
4. William A. Arbaugh and Jon Edney, “Real 802.11 Security: Wi-Fi Protected Access and 802.11I”, First Edition, Pearson Education, 2011.
5. Eldad Perahia and Robert Stacey, "Next Generation Wireless LANs: Throughput, Robustness, and Reliability", 2nd Edition, Cambridge University Press, 2013.
6. Anurag Kumar, D. Manjunath, Joy Kuri, "Wireless Networking: An Analytical Approach (The Morgan Kaufmann Series in Networking)”, Morgan Kaufmann, First Edition, 2008.

18CS3097	Wireless Local and Personal Area Networks	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. understand wireless networking concepts
2. identify wireless & personal network goals and network applications
3. demonstrate the Wireless Network Standards, such as IEEE 802.11, IEEE 802.15, and IEEE 802.16

Course Outcomes:

The student will be able to

1. understand the evolution of wireless systems
2. describe wireless data communication and networking concepts & Protocols.
3. recognize Wireless PAN and Wireless LAN technologies.
4. compare different wireless technologies
5. state the wireless PAN and LAN standars.
6. illustrate the emerging trends in Wireless communication like WiMAX, WiFi and related issues and challenges

Module 1: Introduction to Information Networks

Introduction - Evolution of Local Networks - Characteristics of the Wireless Media

Module 2: Ethernet

IEEE 802.3 Ethernet: Introduction – Legacy Ethernet – Evolution of physical layer

Module 3: Wireless Local-Area Network I

IEEE Wireless Local-Area Network Standards: Introduction - IEEE 802.11 and WLANs

Module 4: Wireless Local-Area Network II

IEEE 802.16 (WiMAX): General Architecture, Physical Layer, Medium Access Control Layer of WiMAX

Module 5: Wireless Personal-Area Network I

IEEE 802.15 Wireless Personal-Area Network: Introduction - IEEE 802.15.1 Bluetooth - Interference between Bluetooth and 802.11

Module 6: Wireless Personal-Area Network II

IEEE 802.15.3A Ultra Wideband Wireless: Direct Sequence Ultra Wideband, Multiband Orthogonal Frequency-Division Multiplexing - IEEE 802.15.4 ZigBee: Overall Architecture - Protocol Stack - Medium Access Control Layer - Physical Layer - Frame Format - Comparison of ZigBee with Bluetooth and WiFi

Reference Books:

1. Kaveh Pahlavan, “Networking Fundamentals - Wide, Local and Personal Area Communications”, Wiley (2009) ISBN: 978-0-470-99289-0
2. Shao-Qiu Xiao, “Millimeter wave technology in wireless PAN, LAN, AND MAN”, Auerbach Publications, CRC Press, 2008. ISBN 9780849382277

18CS3098	Wireless Network Lab	L	T	P	C
		0	0	4	2

Course Objectives:

Enable the student to

1. simulate various communication and mobility models of wireless networks.
2. understand the characteristics of wireless MAC Protocols.
3. analyze the performance of wireless routing protocols

Course Outcomes:

The student will be able to

1. identify novel mechanisms and systems for supporting mobile computing and communications including wireless communication architectures, mobile/wireless TCP and wireless LAN; multimedia sensor networks and mobile adhoc networks.
2. summarize the steps to setup wireless network scenarios using NS2 and analyze the simulation results.
3. model network topologies for the selected protocols and technologies, including internetworking with routers and routing protocols.
4. demonstrate the packet flow, packet drop visually for the wireless ad hoc networks.
5. design basic networks using selected protocols and technologies, including internetworking with routers and routing protocols.
6. justify the performance comparison between routing protocols in wireless mobile ad hoc networks.

List of Experiments

1. Study of wireless networks, Network Simulator (NS2) tool, TCL, awk scripting languages
2. Simulation of Mobile Ad-Hoc Network
3. Performance evaluation of TCP over wireless networks
4. Performance evaluation of MANET routing protocols
5. Comparison of TCP and UDP flow in wireless networks
6. Energy Model
7. Wired-cum-wireless scenario
8. MobileIP
9. Tools and utilities for generating massive simulation
10. Extending NS2

The faculty conducting the laboratory will propose a list of experiments, get the approval of HoD and notify it at the beginning of each semester.

18CS3099	Wireless Network Security	L	T	P	C
		3	0	0	3

Course Objectives:

Enable the student to

1. identify various threats in wireless networks and security solutions.
2. analyze the technologies and protocols that support security in wireless networks.
3. appraise the improvements to be appended for enhancing wireless security

Course Outcomes:

The student will be able to

1. recognize the security challenges in wireless networks.
2. discuss and distinguish the technologies that make up secured wireless network.
3. relate the importance of providing security at user and server level.
4. differentiate the key hierarchies of wireless security.
5. combine Bluetooth and VOIP security.
6. estimate the security of public wireless hotspots.

Module 1: Security principles

Attacks, Distinguishing features of wireless, protecting privacy, promoting safety, 1G - 2G - 3G - 4G, Wi-Fi Vulnerabilities, changing the security model, Traditional Security Architecture, Options in Traditional Security Architecture, Different Types of Attacks, Classification of attacks, attacks without keys and attacks on keys.

Module 2: Wireless Information warfare

Functional taxonomy based on wireless information warfare, Design of Wi-Fi Security, Layers, wireless LAN Organization, basics in infrastructure mode, Protocol Details, Radio Bits.

Module 3: IEEE 802.11 WEP
Privacy, Mechanics of WEP, Why WEP is not secure, WPA, RSN and IEEE 802.11i, what is IEEE 802.11i & WPA, difference between RSA and WPA
Module 4: Access Control
Security context, keys, IEEE 802.1X, EAP, and RADIUS, Importance, IEEE802.1x, EAP principles, EAPOL.
Module 5: Upper Layer Authentication
TLS, Kerberos, LEAP, PEAP, TKIP, TKIP overview, implementation, AES CCMP, Overview,
Wi-Fi LAN Coordination, ESS and IBSS, Public Wireless Hotspots, Securing Wireless LAN, Wireless Application Protocol.
Module 6: Bluetooth& Voice over IP
Bluetooth Security Architecture, Threats to Bluetooth Security, jamming, VoIP Security, Voice Network Security vulnerabilities, IP Spoofing and VoIP.

Reference Books:

1. Jon Edney, William A. Arbaugh, Real 802.11 Security Wi-Fi Protected Access and 802.11i, Pearson Edition, Reprint 2007, ISBN: 0321136209.
2. Randall K.Nichols, Panos C. Lekkas, Wireless Security: Models, Threats and Solutions, Tata McGraw Hill, reprint 2006. ISBN-13: 978-0071380386
3. Merrit Maxim, David Pollino, Wireless Security, McGraw-Hill, 2002, ISBN-13: 978 -0072222
4. Simpson Garfinkel, Eugene H. Spafford, Web Security and Commerce, O'Reilly, First Edition. ISBN:156592-269-7.

18CS3100	Wireless Sensor Networks	L	T	P	C
		3	0	0	3

Course Objectives:
Enable the student to
1. understand the basic concepts of wireless sensor network (WSN) and its applications.
2. analyze different wireless technologies.
3. develop new frameworks/protocols/methods for WSN.

Course Outcomes:
The student will be able to
1. identify the important aspects of WSN and its benefits.
2. illustrate the working principles of a WSN.
3. demonstrate the applications of WSN and protocol working of WSN.
4. compare and contrast different wireless technologies, MAC protocols, Routing protocols, Transport protocols.
5. evaluate the performance of transport protocols, traffic management of WSN.
6. develop new frameworks/protocols/methods for WSN.

Module 1: Introduction and overview of Wireless Sensor Networks
Background of Sensor Network Technology - Application of Sensor Networks - Basic overview of the technology - Basic Sensor Network Architectural Elements - Survey of Sensor Networks - Applications of Sensor Networks: Range of Applications - Examples of Category 2 WSN Applications - Examples of Category 1 WSN Applications - Taxonomy of WSN Technology.
Module 2: Basic Wireless Sensor Technology
Sensor Node Technology - Sensor Taxonomy - WN Operating Environment - WN Trends - Wireless Transmission Technology and Systems: Radio Technology Primer - Propagation and Propagation Impairments - Available Wireless Technologies - Campus Applications - MAN/WAN Applications.
Module 3: Medium Access Control Protocols for Wireless Sensor Networks
Fundamentals of MAC Protocols - Performance Requirements - Common Protocols - MAC Protocols for WSNs - Sensor-MAC Case Study - IEEE 802.15.4 LR - WPANs Standard Case Study -

PHY Layer - MAC Layer. Routing Protocols for Wireless Sensor Networks: Data Dissemination and Gathering - Routing Challenges and Design Issues in Wireless Sensor Networks - Routing Strategies in Wireless Sensor Networks.

Module 4: Transport Control Protocols for Wireless Sensor Networks

Transport Control Protocols for Wireless Sensor Networks: Traditional Transport Control Protocols - Transport Protocol Design Issues - Examples of Existing Transport Control Protocols - Performance of Transport Control Protocols - Middleware for Wireless Sensor Networks: WSN Middleware Principles - Middleware Architecture - Existing Middleware.

Module 5: Query Processing and Data Aggregation, Network Security

Query Processing in Wireless Sensor Networks - Data Aggregation in Wireless Sensor Networks - Network Security and Attack Defense: Confidentiality - Integrity - Authenticity - Nonrepudiation - Freshness - Availability - Intrusion detection - Key management.

Module 6: Network Management for Wireless Sensor Networks

Traditional Network Management Models - Network Management Design Issues - Example of Management Architecture: MANNA - Naming - Localization. Operating Systems for Wireless Sensor Networks: Design Issues - Examples of Operating Systems - Performance and Traffic Management: WSN Design Issues - Performance Modelling of WSNs - Case Study: Simple Computation of the System Life Span.

Reference Books:

1. KazemSohraby, Daniel Minoli and TaiebZnati, Wireless Sensor Networks: Technology, Protocols, and Applications, John Wiley and Sons, 2011, ISBN: 9788126527304, 8126527307
2. Jun Zheng, Abbas Jamalippur, Wireless Sensor Networks: A Networking Perspective, John Wiley and Sons, 2014, ISBN: 978-81-265-5124-8.
3. WalteneousDargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice, John Wiley and Sons, 2010, ISBN: 978-0-470-997659.
4. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley and Sons, 2007, ISBN: 978-0471718161.

LIST OF COURSES

Sl.No	Course Code	Course Name	Credits
1	16CS2002	Fundamentals of Java Programming	3:0:0
2	16CS2003	Fundamentals of C Programming	3:0:0
3	16CS2004	Introduction to Data Analytics	3:0:0
4	17CS1001	Fundamentals of Computing and Programming	3:0:0
5	17CS1002	Fundamentals of Computing and Programming Lab	0:0:2
6	17CS2001	Data Structures and Algorithms-I	3:0:0
7	17CS2002	CASE Tools Lab	0:0:2
8	17CS2003	Computer Architecture	3:0:0
9	17CS2004	Computer Networks	3:0:0
10	17CS2005	Cryptography and Network Security	3:0:0
11	17CS2006	Data Structures and Algorithms-II	3:0:0
12	17CS2007	Data Structures and Algorithms Lab	0:0:2
13	17CS2008	Database Systems	3:0:0
14	17CS2009	Database Systems Lab	0:0:2
15	17CS2010	Object Oriented Analysis and Design	3:0:0
16	17CS2011	Object Oriented Programming in C++ Lab	0:0:2
17	17CS2012	Object Oriented Programming in C++	3:0:0
18	17CS2013	Operating System	3:1:0
19	17CS2014	Java Programming Lab	0:0:2
20	17CS2015	Networking Lab	0:0:2
21	17CS2016	Principles of Compiler Design	3:0:0
22	17CS2017	Programming in Java	3:0:0
23	17CS2018	Software Engineering	3:0:0
24	17CS2019	System Software	3:0:0
25	17CS2020	System Software and Compiler Lab	0:0:2
26	17CS2021	Theory of Computation	3:1:0
27	17CS2022	Unix Architecture	3:0:0
28	17CS2023	Unix and Linux Lab	0:0:2
29	17CS2024	Web Technology	3:0:0
30	17CS2025	Web Technology Lab	0:0:2
31	17CS2026	Ad Hoc Networks	3:0:0
32	17CS2027	Business Intelligence	3:0:0
33	17CS2028	C# and .NET programming	3:0:0
34	17CS2029	C# and .Net Programming Lab	0:0:2
35	17CS2030	Computer Graphics	3:0:0
36	17CS2031	Computer Graphics and Applications Lab	0:0:2
37	17CS2032	Database Administration	3:0:0
38	17CS2033	Design Patterns	3:0:0
39	17CS2034	E-Commerce	3:0:0
40	17CS2035	Enterprise Resource Planning	3:0:0
41	17CS2036	Ethics in Information Technology	3:0:0
42	17CS2037	Fundamentals of Human Computer Interaction	3:0:0
43	17CS2038	Fundamentals of Java Programming	3:0:0
44	17CS2039	Information Security	3:0:0
45	17CS2040	Information Security Lab	0:0:2
46	17CS2041	Intelligent Systems	3:0:0
47	17CS2042	Internet Routing Architecture	3:0:0
48	17CS2043	Internet Routing Protocols Lab	0:0:2
49	17CS2044	Introduction to System Administration	3:0:0
50	17CS2045	IP TV and Internet Video	3:0:0
51	17CS2046	IT Infrastructure and Management	3:0:0

52	17CS2047	Machine Learning Principles and Applications	3:0:0
53	17CS2048	Management Information Systems	3:0:0
54	17CS2049	Mobile Application Development in Android	3:0:0
55	17CS2050	Mobile Application Development Lab	0:0:2
56	17CS2051	Mobile Computing	3:0:0
57	17CS2052	Multimedia Lab	0:0:2
58	17CS2053	Multimedia Systems and Design	3:0:0
59	17CS2054	Network Security Lab	0:0:2
60	17CS2055	Programming in J2EE	3:0:0
61	17CS2056	Programming in J2EE Lab	0:0:2
62	17CS2057	Service Oriented Architecture	3:0:0
63	17CS2058	Software Engineering Lab	0:0:2
64	17CS2059	Storage Area Network	3:0:0
65	17CS2060	TCP/IP	3:0:0
66	17CS2061	Total Quality Management	3:0:0
67	17CS2062	Virtualization	3:0:0
68	17CS2063	Wireless and VOIP Security	3:0:0
69	17CS2064	Essentials of Information Technology	3:0:0
70	17CS2065	Information System, Strategy Planning and Management	3:0:0
71	17CS2066	Enterprise Resource Planning Lab	0:0:2
72	17CS2067	Introduction to Data Analytics	3:0:0
73	17CS2068	Fundamentals of Python Programming	3:0:0
74	17CS2069	Programming in Python	3:0:0
75	17CS3001	Access and Identity Management	3:0:0
76	17CS3002	Advanced Computer Architecture	3:0:0
77	17CS3003	Advanced Database Lab	0:0:2
78	17CS3004	Advanced Database Systems	3:0:0
79	17CS3005	Advanced Operating Systems	3:0:0
80	17CS3006	Advanced Operating Systems Lab	0:0:2
81	17CS3007	Analysis, Architecture and Design of Networks	3:0:0
82	17CS3008	Applied Security Lab	0:0:2
83	17CS3009	Cloud Computing Lab	0:0:2
84	17CS3010	Cloud Computing Services	3:0:0
85	17CS3011	Computing Security Lab	0:0:2
86	17CS3012	Design and Analysis of Algorithms	3:0:0
87	17CS3013	Distributed Systems	3:0:0
88	17CS3014	Information Storage Management	3:0:0
89	17CS3015	Internetworking	3:0:0
90	17CS3016	Internetworking and Security Lab	0:0:2
91	17CS3017	Internetworking Lab	0:0:2
92	17CS3018	Mobile AdHoc Networks	3:0:0
93	17CS3019	MPLS and VPN	3:0:0
94	17CS3020	Network Design and Management Lab	0:0:2
95	17CS3021	Network Management	3:0:0
96	17CS3022	Object Oriented Software Engineering	3:0:0
97	17CS3023	Routing and Switching Techniques	3:0:0
98	17CS3024	Security in Computing	3:0:0
99	17CS3025	System Administration	3:0:0
100	17CS3026	System Administration Lab	0:0:2
101	17CS3027	System Development Lab	0:0:2
102	17CS3028	Wireless Networks Lab	0:0:2
103	17CS3029	Wireless Sensor Networks	3:0:0
104	17CS3030	3D Modeling and Rendering	3:0:0

105	17CS3031	Advanced Data mining	3:0:0
106	17CS3032	Applied Medical Image Processing	3:0:0
107	17CS3033	Artificial Intelligence for Games	3:0:0
108	17CS3034	Big Data and Graph Analytics	3:0:0
109	17CS3035	Cloud Computing	3:0:0
110	17CS3036	Computer Graphics and Applications	3:0:0
111	17CS3037	Computer Vision	3:0:0
112	17CS3038	Cyber Forensics	3:0:0
113	17CS3039	Data Mining Lab	0:0:2
114	17CS3040	Data warehouse	3:0:0
115	17CS3041	Database Security	3:0:0
116	17CS3042	Elements of Multimedia Systems	3:0:0
117	17CS3043	Evolutionary Computing	3:0:0
118	17CS3044	Grid Computing	3:0:0
119	17CS3045	Information Security Audit and Assurance	3:0:0
120	17CS3046	Interactive Game Design	3:0:0
121	17CS3047	Internetworking Multimedia	3:0:0
122	17CS3048	IP Telephony	3:0:0
123	17CS3049	Knowledge Management	3:0:0
124	17CS3050	Multimedia Communication	3:0:0
125	17CS3051	Multimedia Database	3:0:0
126	17CS3052	Multimedia Design Storage and Analysis	3:0:0
127	17CS3053	Network Security	3:0:0
128	17CS3054	Parallel Computing	3:0:0
129	17CS3055	Pattern Recognition	3:0:0
130	17CS3056	Pervasive Computing	3:0:0
131	17CS3057	Quantum Computing	3:0:0
132	17CS3058	Real Time System Software	3:0:0
133	17CS3059	Real Time Systems	3:0:0
134	17CS3060	Requirements Engineering	3:0:0
135	17CS3061	Semantic Web	3:0:0
136	17CS3062	Soft Computing	3:0:0
137	17CS3063	Software Agents	3:0:0
138	17CS3064	Software Architecture	3:0:0
139	17CS3065	Software Architecture Restructuring	3:0:0
140	17CS3066	Software Metrics and Quality Management	3:0:0
141	17CS3067	Software Project Management	3:0:0
142	17CS3068	Software Testing	3:0:0
143	17CS3069	User Interface Design	3:0:0
144	17CS3070	Virtual Reality Technology	3:0:0
145	17CS3071	Web Security	3:0:0
146	17CS3072	Web Services	3:0:0
147	17CS3073	Wireless Security	3:0:0
148	17CS3074	Social Network Analysis	3:0:0
149	17CS3075	Machine Learning Techniques	3:0:0
150	17CS3076	Binary and Malware Analysis	3:0:0
151	17CS3077	Internet of Things	3:0:0
152	17CS3078	Big Data Platforms	3:0:0
153	17CS3079	High Performance Networks	3:0:0
154	17CS3080	Enterprise Service Oriented Architecture	3:0:0
155	17CS3081	Internet of Things Lab	0:0:2
156	17CS3931	Research Paper Writing Skills	0:0:1

16CS2002 FUNDAMENTALS OF JAVA PROGRAMMING

Credits: 3:0:0

Course Course Objectives:

Enable the student to

- learn the Java programming language fundamentals: its syntax, idioms, patterns, and styles.
- demonstrate the concept of the object oriented paradigm.
- apply the essentials of the Java class library.

Course Course Outcomes:

The student will be able to

- understand the fundamental principles of object-oriented design.
- develop desktop based applications.
- debug Java programs.

Description:

Introduction to Java; Pattern Generation using Control Statements; Matrix Manipulation using Array; Billing Software System using Classes, Inheritance, Packages, Interfaces and Exception Handling; Inventory Management System using Multithreading, Enumeration and Autoboxing; Word Puzzle Game using String Manipulation; File Management using Java Input/Output; Introduction to Graphical User Interface Application using Swing.

Reference Books:

1. Herbert Schildt, Java: The Complete Reference, McGraw Hill Education, Ninth Edition, 2014. ISBN-13: 978-0071808552
2. Paul Deitel, Harvey Deitel, Java How to Program, Pearson, Tenth edition, 2014. ISBN-13: 978-0133807806
3. Bruce Eckel, Thinking in Java, Fourth Edition, Prentice Hall, 2006. ISBN: 978-0131872486.
4. Kathy Sierra, Bert Bates, Head First Java, Second Edition, O'Reilly Media, 2005. ISBN: 10-0596004656, ISBN-13:9780596004651.

16CS2003 FUNDAMENTALS OF C PROGRAMMING

Credits: 3:0:0

Course Course Objectives:

Enable the student to

- learn the basics of C programming.
- demonstrate the application of functions, recursions and pointers.
- develop programs to solve real time problems.

Course Course Outcomes:

The student will be able to

- solve the given problem using syntactical structure of C.
- use advanced constructs and standard library functions in C programming.
- apply file I/O operations for real-time applications.

Description:

Introduction to C Programming, Variables and Data Types, Operators and Expressions, Data Input and Output, Preparing and running a complete C program, Control Statements, Functions, Recursion, Arrays, Strings, Pointers, Structures and Unions, File I/O.

Reference Books:

1. Byron S. Gottfried, "Programming with C", McGraw Hill Education; 3 edition (27 July 2010), ISBN-10: 0070145903.
2. Ashok N. Kamthane, "Fundamentals of Computer Programming",2013, Pearson, ISBN 978-93-325-1549-9.
3. Herbert Schildt, "The Complete Reference C", Fourth Edition, McGraw-Hill Publications, 2007, ISBN: 978-0072121247.
4. Yashwant kanetkar, "Let us C",10th Edition, BPB Publications,2010, ISBN: 978-81-8333-163-0.

5. Kashi Nath Dey, Samir Bandyopadhyay, "C Programming Essentials", 2010, Dorling Kindersley (India) Pvt. Ltd., ISBN: 978-81-317-2889-5.
6. Anita Goel, Ajay Mittal, "Computer Fundamentals and Programming in C", 2013, Dorling Kindersley (India) Pvt. Ltd., ISBN: 978-93-325-1934-3.
7. E.Balagurusamy, "Programming in ANSI C", Sixth Edition, Tata McGraw Hill, 2012, ISBN: 978-1-25-900461-2.

16CS2004 INTRODUCTION TO DATA ANALYTICS

Credits: 3:0:0

Course Course Objectives:
Enable the student to

- understand the basics of digital data and its types
- explain the various classification and clustering techniques
- adapt big data technologies for data analytics

Course Course Outcomes:
The student will be able to

- change any digital form of data to specific format for analytics
- identify the relevant algorithms to perform analytics on real world data
- formulate decisions based on the analyzed data

Course Description:
Introduction, types of digital data, structured, unstructured and semi-structured data, real learning examples: email spam, handwritten digit recognition, linear methods for regression, linear methods for classification, classification and prediction: decision tree induction, Bayesian classification, support vector machines, cluster analysis: types of data in cluster analysis, partitioning based clustering algorithms, introduction to big data: characteristics, applications, Big data analytics, The big data technology landscape.

Reference Books:

1. Hastie, Trevor, Robert Tibshirani and Jerome Friedman, "The elements of statistical learning – Data mining, Inference and Prediction", Second Edition, springer, 2009, ISBN : 978-0-387-84857-0
2. Jiawei Han and Micheline Kamber, "Data Mining Concepts and Techniques", Chris Ullman, Morgan Kaufmann Publishers, Third Edition, 2011, ISBN : 0123814790, ISBN -13 9780123814791
3. Seema Acharya and Subhashini Chellappan, "Big data and analytics", John Wiley and Sons, 2015

17CS1001 FUNDAMENTALS OF COMPUTING AND PROGRAMMING

Credits: 3:0:0

Course Objectives:
Enable the student to

- study the basic of computers.
- understand the basic syntax of C programming.
- learn concepts of functions, pointers, structures and apply it into real word problems

Course Outcomes:
The student will be able to

- describe the basic functions of computers.
- extend the pseudo-code into coding by using C programming.
- use the C program to solve the real world problems.
- illustrate the C programming concepts to solve the computational problems.
- develop C programs using arrays, strings and functions.
- select the required user defined data types according to given problem statements.

Unit I - Introduction to Computers: Introduction - Characteristics of Computers - Evolution of Computers - Generation of Computers - Classifications of Computers - Basic Computer Organization - Computer Software and Types - Internet - Types of Internet connection - Number Systems.

Unit II - Problem Solving Techniques and Overview to C: Algorithm - Flow chart - Structure of a C Program - C character set - Keywords - Identifiers - Data types - Input and Output in C - Operators - Operator priority and Associativity - Type Conversion.
Unit III - Control Statements and Looping: Program Control Structures - Loop Statements - break and continue - Arrays -Multidimensional Array- Strings - String functions.
Unit IV - Functions and Storage Classes: Functions - Functions with Arrays - Recursion - Storage Classes - Enumerated data type - Renaming Data Types (typedef).
Unit V - Pointers and Structures: Pointers - Pointer to a function - Pointer to arrays - Structure - Array of Structures - Union.

Text Book:

1. Ashok N. Kamthane, "Fundamentals of Computer Programming", Pearson, 2013, ISBN 978-81-317-0007-5.
2. Byron Gottfried, "Schaum's Outlines Programming with C", Third Edition, 2010, McGraw Hill Education, ISBN: 9780070145900

Reference Books:

1. YashwantKanetkar, "Let us C", 14th Edition, BPB Publications, 2016, ISBN 8183331637.
2. E. Balagurusamy, "Programming in ANSI C", 6th Edition, Tata McGraw Hill, 2012, ISBN 978-1259004612.
3. AnithaGoel, Ajay Mittal, "Computer Fundamentals and Programming in C", Dorling Kindersley (India) Pvt. Ltd., 2013, ISBN 978-93-325-1934-3. K R Venugopal, Sudeep R Prasad, "Mastering C", Second Edition, McGraw Hill Education, 2015, ISBN: 978-9332901278.
4. Pradip Dey and Manas Ghosh," Programming in C", Oxford University Press, New Delhi, 2009, ISBN: 9780198061175

17CS1002 FUNDAMENTALS OF COMPUTING AND PROGRAMMING LAB

Credits: 0:0:2
Co -requisite: 17CS1001 Fundamentals of Computing and Programming

Course Objectives:
Enable the student to

- learn the procedure oriented programming methodology using C.
- write well structured, high quality C program.
- provide solutions to real world problem by using C programming concepts.

Course Outcomes:
The student will be able to

- describe the basic structure of C program.
- give examples for using control and iteration statement in C.
- apply the C programming concepts while developing applications.
- illustrate the use of functions to solve the computational problems.
- develop C programs using arrays, stings and pointers.
- explain the use of structures and unions in developing applications.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2001 DATA STRUCTURES AND ALGORITHMS - I

Credits: 3:0:0
Course Objectives:
Enable the student to

- understand the concepts of linear data structures and techniques of sorting and searching.
- demonstrate the different applications of data structures.
- understand the asymptotic performance and various strategies of algorithm design.

Course Outcomes:
The student will be able to

- name the data structures used in different applications.

- describe the basic operations carried out on a data structure.
- illustrate the working of sorting and searching algorithms.
- identify the suitable data structure for the storage of data involved in the application.
- develop applications using various linear data structures by applying Brute force and divide and conquer algorithm design strategies.
- choose the appropriate data structure and algorithm design strategies for real time application development.

Unit I - Introduction to Data Structures and Stack: Arrays and Memory Address Calculation in Arrays, Pointers and Structures in C/C++ - Array implementation - Polish notation - Infix to Postfix conversion - Postfix expression evaluation - Recursion - Towers of Hanoi problem.
Unit II - Queues and Linked lists: Definition, Array implementation of queue - Circular queue - Singly linked lists, Doubly linked lists - Circular linked lists - Linked stack - Linked queue.
Unit III -Algorithm Analysis: Analysis framework - Performance Analysis - Asymptotic notations and basic efficiency classes - Mathematical analysis of non-recursive algorithms - Mathematical analysis of recursive algorithms - Substitution Method - Recursion Tree Method - Master's Theorem.
Unit IV - Brute Force Algorithm Design and Sorting Algorithms: Sequential search and brute–force string matching - Bubble Sort - Selection Sort - Insertion Sort - Radix Sort - Hashing
Unit V - Divide-and-Conquer Algorithm Design: Binary Search - Fibonacci Numbers - Exponential Problem - Finding Min and Max - Merge Sort - Quick Sort - Multiplication of large integers and Strassen's Matrix Multiplication.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, 2007, ISBN: 0-929306-40-6.
2. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", Third Edition, Prentice Hall, 2010, ISBN: 9788120340077.
3. Ellis Horowitz, Sartaj Shani, Sanguthuvar Rajasekaran, "Fundamentals of computer Algorithms", Second Edition, 2008. ISBN- 978-81-7371-612-6

Reference Books:

1. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, First Edition Reprint 2003.Fourth impression,2009, ISBN 978-81-7758-8262
2. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, Data Structures Using C and C++, Second Edition, PHI/Pearson Education, 1996. ISBN 978-81-203-1177-0.
3. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Third Edition, Addison Wesley, 2006. ISBN: 032144146X.Third Impression 2009

17CS2002 CASE TOOLS LAB

Credits: 0:0:2
Co-requisite: 17CS2010 Object Oriented Analysis and Design

Course Objectives:
Enable the student to

- design UML diagrams and to develop applications.
- help the students to visualize the structure of the system and to reduce the system development time thereby increasing the productivity according to the industrial standards.

Course Outcomes:
The student will be able to

- identify the importance of systems analysis and design in solving complex problems.
- express the design views in various real time applications.
- apply the software suit for the construction of UML models and expressing appropriate notation associated with each model.
- relate the design knowledge into any software products.
- construct the various UML models using the appropriate notation.
- describe the requirements for implementing the UML diagrams.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2003 COMPUTER ARCHITECTURE

Credits: 3:0:0

Course Objectives:

Enable the student to

- provide knowledge of the fundamentals of computer architecture.
- discuss in detail the operation of the control Unit and arithmetic operations.
- study in detail the different types of control and the concept of pipelining.

Course Outcomes:

The student will be able to

- describe the computer architecture concepts and design principles.
- summarize the architecture and working of computer.
- illustrate the arithmetic, addressing modes and instruction execution.
- analyse the different types of interrupts in computer system.
- relate the knowledge into the - Micro Program Control.
- explain the concept of cache memory working.

Unit I - Computer Organization and Cache: Computer organization & architecture - Function & Structure - Top level view of computer components - Computer function - Interrupts - Multiple interrupts - Cache memory.
Unit II - Memory Systems and External Devices: Computer memory systems overview - Semiconductor main memory - Error correction - Advanced DRAM organization - External devices and I/O modules - Programmed I/O - Interrupt driven I/O - Direct Memory.
Unit III - Computer Arithmetic and Addressing: Computer Arithmetic - M/C instruction characteristics - Types of operands - Types of operation - Transfer of control - Pentium operations - PowerPC operations - Assembly language - Addressing - Pentium & PowerPC addressing modes.
Unit IV - Internal Organization and Instruction Cycle: Processor and Register organization - Instruction cycle - Instruction pipelining - Intel 80486 pipelining - Pentium & Power PC processors.
Unit V - Micro Operations: Micro operations - Control of the CPU - Intel 8085 - Hardwired implementation - Micro programmed control basic concept - Microinstruction sequencing - Microinstruction execution.

Text Book:

1. William Stallings, Computer Organization and Architecture: Designing for Performance, Eighth Edition, Pearson Education, 2010, ISBN: 8131732452.

Reference Books:

1. Harvey M. Dietel, Java How to Program, Ninth Edition, Prentice Hall, 2012. ISBN 978-0-13-257566-9.
2. Kathy Sierra, Bert Bates, Head First Java, Second Edition, O'Reilly Media, 2005, ISBN: 10-0596004656, ISBN-13:9780596004651.
3. Bruce Eckel, Thinking in Java, Fourth Edition, Prentice Hall, 2006, ISBN: 978-0131872486.
4. Ken Arnold, James Gosling, David Holmes, The Java Programming Language, Fourth Edition, Prentice Hall Professional Technical Reference, 2005, ISBN-13:9780321349804
5. E. Balagurusamy, Programming with Java: A primer, Third Edition, Tata McGraw-Hill, 2007.

17CS2004 COMPUTER NETWORKS

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the protocol layers and their service models.
- compare and analyze connectionless and connection oriented transport protocols.
- manage the network infrastructure.

Course Outcomes:

The student will be able to

- describe the protocol layers, Internet protocol and their service models.

- identify the factors influencing computer network infrastructure and development.
- apply the network protocols in building the computer networks.
- analyze the routing algorithms and their behaviors.
- design computer networks with optimized address assignment.
- evaluate the performance and characteristics of network protocols.

Unit I - Computer Networks and the Internet: Introduction - network edge -network core -delay -loss -and throughput -protocol layers and their service models
Unit II - Application layer: principles of network applications -the Web and HTTP -File Transfer: FTP -Electronic Mail in the Internet -DNS -peer to peer applications -socket programming creating networking applications: TCP and UDP
Unit III - Transport layer: introduction to transport layer services -multiplexing and demultiplexing -connectionless transport: UDP -principles of reliable data transfer: rdt1.0 -rdt2.0 -rdt2.1 -rdt2.2 and rdt3.0 -Go-back-N protocol -Selective repeat protocol -connection-oriented transport: TCP -TCP connection management -principles of congestion control -TCP congestion control
Unit IV - The network layer: introduction -virtual circuit and datagram networks -architecture inside a router -Internet Protocol (IP): Forwarding and addressing in the Internet -Network Address Translation -Internet Control Message Protocol (ICMP) -IPv6 -routing algorithms -LSRP -DVRP -routing in the Internet
Unit V - The link layer: introduction -error detection and correction techniques - multiple access links and protocols- switched local area networks -Ethernet -virtual local area network -network management

Text Books:
1. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, sixth Edition, Addison-Wesley, 2013, ISBN-13: 9780132856201
2. William Stallings, Data and Computer Communications, Prentice Hall, Eighth Edition, 2007, ISBN9780132433105.

Reference Books:
1. Andrew S.Tanenbaum, Computer Networks, Prentice Hall of India, Fifth edition, 2010 ISBN-13: 978-0132126953.
2. Fred Halsall, Computer Networking and the Internet, Fifth Edition, Addison-Wesley, 2005, ISBN 9780321263582
3. Kevin R. Fall, W. Richard Stevens, TCP/IP Illustrated Volume - I: The Protocols, Addison Wesley Professional Computing Series, 2011, Second Edition, ISBN-13:978-0321336316.

17CS2005 CRYPTOGRAPHY AND NETWORK SECURITY

Credits: 3:0:0

Course Objectives:
Enable the student to
- classify the different kinds of security issues.
- apply the various principles of cryptosystems, hashing algorithms and digital signatures.
- create awareness on the various methods for designing firewalls and trusted systems.

Course Outcomes:
The student will be able to
- recognize the importance of network security.
- distinguish different kinds of attacks and design new security features.
- practice the various symmetric and asymmetric key algorithms.
- categorize cryptographic data integrity algorithms.
- explain the different types of firewalls.
- evaluate network and internet security.

Unit I - Symmetric Key Ciphers: Computer Security Concepts - OSI Security Architecture -Security Attacks - Services, Mechanisms -Symmetric Cipher Model - Traditional Block Cipher Structure - The Data Encryption Standard -The Strength of DES - Advanced Encryption Standard - Multiple Encryption and Triple DES - Modes of Operation.

Unit II - Asymmetric Key Ciphers: Public Key Cryptography - RSA - Diffie-Hellman Key Exchange -El Gamal Cryptographic system - Elliptic Curve Cryptography.
Unit III - Hashing and Authentication Algorithms: Secure Hash Algorithm - Hashed Message Authentication Codes - Cipher based Message Authentication Codes -Digital Signature Algorithm - Symmetric Key Distribution using Symmetric and Asymmetric Encryption - Distribution of Public Keys - X.509 Certificates.
Unit IV - E-Mail and IP Security: Remote User Authentication Principles - Kerberos Version 5 - Pretty Good Privacy - S/MIME - IP Security Overview - Encapsulating Security Payload.
Unit V - Web Security: Transport level security - Web security considerations - Secure Socket Layer - Intruders and Intrusion Detection System - Need for Firewalls - Firewall Characteristics - Types of Firewalls.

Text Books:

1. William Stallings, Cryptography and Network Security, Sixth Edition, Pearson, 2014, ISBN 13: 978-0-13-335469-0.

Reference Books:

1. Atul Kahate, Cryptography and Network Security, 8th reprint, Tata McGraw Hill, 2006, ISBN: 0-0-07-049483-5.
2. Wenbo Mao, Modern Cryptography, First Edition, Pearson Education, 2008 ISBN: 978-81-317-0212-3
3. Roberta Bragg, Mark Rhodes, Keith Strassberg, Network Security, Tata McGraw Hill Edition, 2008. ISBN-13: 978-0-07-058671-0.
4. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, Second Edition, Pearson Education, 2016, ISBN-13: 978-9332578210

17CS2006 DATA STRUCTURES AND ALGORITHMS - II

Credits: 3:0:0
Pre-requisite: 17CS2001 Data Structures and Algorithms - I

Course Objectives:

- enable the student to evaluate the non-linear data structures such as trees and graphs.
- illustrate the various recursive and non-recursive algorithms.
- formulate algorithmic techniques for solving any given problem.

Course Outcomes:
The student will be able to

- describe the various algorithm design techniques.
- select an appropriate design technique for finding solution to a problem.
- apply the design technique for solving a problem.
- analyse the efficiency of various algorithms.
- set up the best and worst case scenarios of various algorithms.
- compare the efficiencies of different solutions to a particular problem.

Unit I - Tree: Binary Tree - Representation - Traversals of Binary Tree and Implementation - Binary Search Trees - AVL Trees - Binary Heap and Application - Multiway Search Trees - B-trees
Unit II - Graphs and Greedy Algorithm Design: Mathematical background, representation - Graph traversals (DFS & BFS) - Topological Sort - Shortest path algorithm - Minimum spanning trees.
Unit III - Greedy Algorithm Design: Huffman Codes - Optimal Merge Patterns - Job Sequencing with Deadlines - Knapsack Problem.
Unit IV - Dynamic Programming: All pairs shortest path - Travelling Salesman Problem - 0/1 Knap Sack Problem - Matrix Chain Multiplication - Longest Common Subsequence - Optimal Binary Search Tree.
Unit V - Back Tracking: N Queen's problem - Sum of Subsets, P and NP class problems.

Text Books:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, 2007, ISBN: 0-929306-40-6.
2. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", Third Edition, Prentice Hall, 2010, ISBN: 9788120340077.

3. Ellis Horowitz, Sartaj Shani, Sanguthuvar Rajasekaran, "Fundamentals of computer Algorithms", Second Edition, 2008. ISBN- 978-81-7371-612-6

Reference Book:

1. Jon Kleinberg, Eva Tardos, "Algorithm Design", First Edition, Pearson Education, 2014. ISBN-978-93-325-1864-3
2. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2011. ISBN-13: 978-0132316811
3. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, First Edition Reprint 2003.Fourth impression,2009, ISBN 978-81-7758-8262
4. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, Data Structures Using C and C++, Second Edition, PHI/Pearson Education, 1996. ISBN 978-81-203-1177-0.
5. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Third Edition, Addison Wesley, 2006. ISBN: 032144146X.Third Impression 2009

17CS2007 DATA STRUCTURES AND ALGORITHMS LAB

Credits: 0:0:2
Co-requisite: 17CS2006 Data Structures and Algorithms - II

Course Objectives:
Enable the student to

- develop skills to design linear and non linear data structures.
- identify and apply the suitable data structure for the given real world problem.
- gain knowledge in practical applications of data structures.

Course Outcomes:
The student will be able to

- describe the fundamentals of linear and non-linear data structures.
- identify the pros and cons of the implementation of data structures using arrays and linked list.
- choose the suitable data structure for the storage of data involved in the application.
- compare the working of various sorting and searching methods.
- develop applications using stacks, queues, binary trees and graphs.
- select the appropriate data structure and algorithm for real time applications.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

17CS2008 DATABASE SYSTEMS

Credits: 3:0:0

Course Objectives:
Enable the student to

- gain knowledge on design and implementation of database management system.
- understand the fundamentals of relational systems including data models, database architectures, and database manipulations.
- acquire knowledge of new developments on trends such as Internet database environment and data warehousing.

Course Outcomes:
The student will be able to

- recognize the role of database administrator and database management systems in software applications.
- convert the logical design of a database into its physical design.
- use query language to retrieve data efficiently from the database.
- analyse the normality of a logical data model, and correct any anomalies.
- design and implement significant database objects such as file structures and index schemes.
- describe techniques for transaction processing and concurrency control.

Unit I - Introduction: Database-System Application - Purpose of Database System - View of Data, Database Language - Relational Database - Database Design - Object-Based and Semi-structured Databases - Data Storage and Querying - Transaction Management - Data mining and Analysis - Database Architecture - Database Users and Administrators. Relational Model: Structure of Relational Databases - Fundamental Relational-Algebra operations - Additional Relational Algebra operations - Extended Relational Algebra - Null value, Modification of the database.
Unit II - SQL: Background - Data Definition - Basic Structure of SQL Queries - Set Operations - Aggregate functions - Null values - Nested sub queries - Complex Queries - Views - Modification of Database. Advanced SQL: SQL Data Types and Schema - Integrity Constraint - Authorization - Embedded SQL - Dynamic SQL. Application Design and Development: Triggers - Authorization in SQL.
Unit III - Database Design And E-R Model: Overview of the design process - E-R model - Constraints -E-R Diagram - E-R Design Issues - Weak Entity - Extended E-R Features - Database Design for Banking Enterprise - Reduction to Relational Schema. Database-System Architecture: Centralized and Client-Server Architecture - Server System Architecture.
Unit IV - Relational Database Design: Features of good Relational Design - Atomic Domains and First Normal Form - Decomposition Using Functional dependencies - Functional Dependency Theory - Decomposition Using Functional Dependencies - Multivalued Dependencies - More Normal form - Database-Design Process - Modeling Temporal data.
Unit V - Storage and File Structure: File organization - Organization of records in files - Data Dictionary Storage. Indexing and Hashing: Basic Concept - Ordered Indices - B+ Tree Index Files - B-Tree-Index Files - Multiple-Key Access - Static Hashing - Dynamic Hashing - Comparison of Ordered Indexing and Hashing. Transaction: Transaction concepts - Transaction State - Implementation of atomicity and durability - Concurrent executions - Serialization.

Text Book:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, Sixth Edition, Mc Graw-Hill Education, 2010. ISBN 978-0073523323.

Reference Books:

1. Ramez Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Seventh Edition, Pearson Education, 2017, ISBN 978-0133970777.
2. Garcia Molina, Database Systems: The Complete Book, Third Impression, 2009, ISBN 978-81-317-0842-2.
3. Raghu R. and Johannes G., Database Management Systems, Third Edition, Tata McGraw Hill, 2014. ISBN 978-9339213114

17CS2009 DATABASE SYSTEMS LAB

Credit: 0:0:2
Co-requisite: 17CS2008 Database Systems

Course Objectives:
Enable the student to

- understand the concepts of basic query language
- apply the fundamentals of DDL, DML DCL and TCL.
- implement new developments and trends in developing a database

Course Outcomes:
The student will be able to

- describe the table and column structures
- explain the basics of data management and administration.
- apply the normalization on logical data model, and correct any anomalies.
- analyze the various types of online applications.
- compose web pages with backend support
- discriminate the types of various database objects like views, synonym, triggers, procedures etc.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

17CS2010 OBJECT ORIENTED ANALYSIS AND DESIGN

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the basics of object oriented software development.
- analyse the issues in modelling the object oriented applications using UML.
- evaluate the classes, attributes, methods and relationships of any real world objects.

Course Outcomes:

The student will be able to

- describe the various object oriented concepts.
- recognize the requirements of any real time application.
- sketch the design of any application using UML diagram.
- identify various prototypes to represent the application.
- prepare the documentation of any real time application.
- explain the application in terms of use case driven approach.

Unit I - Object Basics: Object oriented philosophy - objects, classes, and attributes - object behavior and methods - encapsulation and information hiding - class hierarchy - polymorphism - object relationships and associations - aggregations and object containment - case study - object identity - persistence. Object oriented systems development life cycle - Software development process - building high quality software - use- case driven approach - reusability.

Unit II - Object Modeling: Rumbaugh et al.'s object modeling technique - Booch methodology - Jacobson et al. methodologies - patterns - frameworks - the unified approach - Unified modeling language - Static and dynamic models - UML diagrams - UML class diagrams - use-case diagrams - UML dynamic modeling - packages- UML extensibility and UML metamodel.

Unit III - Business Object Analysis: Use-case driven object oriented analysis - business process modeling - use-case model - developing effective documentation - case study- Classification - Classification theory - noun phrase approach - common class patterns approach - use-case driven approach -classes - responsibilities - and collaborators-naming classes.

Unit IV - Association: Super-subclass relationships - a-part of relationships - case study - class responsibility - defining attributes for net bank objects - object responsibility - defining methods for net bank objects -Design process and design axioms - Corollaries - design patterns.

Unit V - UML Object Constraint Languages: Designing classes - class visibility - refining attributes for the net bank objects - designing methods and protocols - designing methods for the net bank objects - packages and managing classes - Designing Access Layer Classes - Case Study- Designing - The Access Layer for the net Bank ATM - Designing View Layer Classes - Macro Level Process - Micro Level Process.

Text Book:

1. Ali Bahrami, Object Oriented Systems Development using the Unified Modelling Language, McGraw Hill, Second Reprint 2008, ISBN: 978-0-07-026512-7.

Reference Books:

1. Grady Booch, Object Oriented Analysis and Design with Applications, Addison Wesley, Third Edition, September 2009, ISBN 978-81-317-2287-9.
2. Simon Benett, Object Oriented Analysis and Design Using UML, Third Edition, Publication Date: August 1, 2005 | ISBN-10: 0077110005 | ISBN-13: 978-0077110000.
3. AtulKahate, Object Oriented Analysis and Design, First Edition, McGraw-Hill, 2004. ISBN: 0070583765.
4. Joseph Schmuller, UML, Third Edition, Pearson Education, 2004. ISBN: 81-297-0609-1.

17CS2011 OBJECT ORIENTED PROGRAMMING IN C++ LAB

Credits: 0:0:2
Co -requisite: 17CS2012 Object Oriented Programming in C++

Course Objectives:
Enable the student to

- write high quality program, internally documented, well-structured C++ program.
- learn the programming methodology, how C++ supports object oriented principles.
- provide solution for apply these principles in software development.

Course Outcomes:
The student will be able to

- describe the procedural and object oriented paradigm with the concepts of streams, classes, functions, data and objects.
- give examples for using control statements in C++.
- choose to use functions and the concepts related to good modular design wherever necessary while developing applications.
- illustrate handling of exceptions in an application.
- develop programs using dynamic memory management techniques, pointers, constructors and destructors.
- explain the use of templates and file management in developing applications.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2012 OBJECT ORIENTED PROGRAMMING IN C++

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the basic concepts of C++.
- develop high quality, internally documented, well-structured C++ program.
- adapt object oriented principles such as abstraction, information hiding, localization and modularity in software development.

Course Outcomes:
The student will be able to

- define the object-oriented programming concepts.
- select the relevant object oriented concepts to implement a real time application.
- demonstrate the application of polymorphism in various ways.
- illustrate the use of advanced features of C++ such as templates, exceptions, and multiple inheritances.
- create applications using inheritance in C++.
- explain file management and string manipulation.

Unit I - Introduction: Object oriented programming- Characteristics of Object Oriented Languages. C++ programming basics: Basic program construction - data types: signed and unsigned, Input &output statements: cin - cout - directives- comments - manipulators-escape sequence -type conversion - arithmetic, relational and logic operators - and library function.
Unit II - Loops, Decisions & Functions: Decisions & other control statements, Structures: Structures-Enumeration. Functions: Simple functions - passing arguments to functions - returning values from functions - reference arguments - overloaded functions - inline functions - default arguments - variables and storage class and returning by reference-const function arguments.
Unit III - Object, Classes, Array and Strings: A simple class - C++ objects as physical objects - C++ objects and data types - object as function argument - constructors - object as function argument - overloaded constructors - copy constructors - returning objects from functions - structures and classes - static class data - const and classes - Arrays and Strings: Array fundamentals-function declaring with array arguments-array as class member data-array objects-C strings-standard C++ string class.
Unit IV - Operator Overloading, Inheritance & Pointers: Overloading unary and binary operators - data conversion - and pitfalls. Inheritance: derived class and base class - derived class constructors - overloading member

functions - class hierarchies - public and private inheritance - level of inheritance - multiple inheritances. Pointers: address and pointers - pointers and arrays - pointer and c-type strings - new and delete operator - pointers to pointer.
Unit V - Virtual Functions, Streams and Files, Templates & Exceptions: Virtual functions - friend functions - static functions - this pointer. Streams and files: stream classes -stream errors - disk file I/O with streams - file pointers - error handling in file I/O. Templates and exception: function templates - class templates - exceptions.

Text Books:

1. Herbert Schildt, C++: The Complete Reference, Fifth Edition, Tata McGraw-Hill, 2015. ISBN 978-0071634809.
2. Robert Lafore, Object Oriented Programming in C++, Fourth Edition, Tech Media, 2008. ISBN 0-672-32308-7.

Reference Books:

1. Joyce Farrell, Object-Oriented Programming Using C++, Fourth Edition, Cengage Learning, 2013, ISBN 978-8131519431.
2. Paul J. Deitel, Harvey M. Deitel, C++: How to Program, Pearson, 2014, ISBN 780273793298.
3. BjarneStroustrup, Programming Principles and Practice using C++, Second Edition, Addison Wesley, Pearson Education, 2014, ISBN: 978-0321543721.

17CS2013 OPERATING SYSTEM

Credits: 3:1:0

Course Objectives:
Enable the student to

- understand the operating system concepts.
- gain knowledge about the operating systems concepts such as process, main memory management, and secondary memory management.
- apply CPU and disk scheduling algorithms.

Course Outcomes:
The student will be able to

- define and describe the operating system and its structures.
- distinguish between process and threads.
- choose different process scheduling algorithms.
- illustrate critical section problem and synchronization.
- explain deadlock detection and avoidance.
- summarize the different algorithms and techniques of operating system.

Unit I - Operating System Introduction: What Operating Systems Do - Computer System Organization Computer System Architecture - Operating System Structure - Operating System Operations - Process Management - Memory Management - Storage Management - Protection and Security - Distributed Systems - Special Purpose Systems - Computing Environments - Operating System Services - User Operating System Interface - System Calls - Types of System Calls - System Programs - Operating System Design and Implementation - Operating System Structure - Virtual Machines - Operating System Generation - System Boot.
Unit II - Process Management: Process Concept - Process Scheduling - Operation on Processes - Inter-process Communication- Multithreaded Programming -Multithreading models - Thread Libraries - Threading Issues - Process Scheduling - Basic concepts - Scheduling Criteria - Scheduling Algorithms - Multiple Processor Scheduling - Thread Scheduling
Unit III - Synchronization & Memory Management: The Critical Section Problem - Peterson's Solution - Synchronization Hardware - Semaphores - Classic Problems of Synchronization - Monitors - Atomic Transactions - System Model - Deadlock Characterization - Methods for Handling Deadlocks -Deadlock Prevention - Deadlock avoidance - Deadlock detection - Recovery from Deadlock -Memory management Strategies - Swapping - Contiguous memory Allocation - Paging - Structure of the Page Table - Segmentation.
Unit IV - Virtual Memory Management & File Management: Demand Paging - Copyon-Write - Page Replacement - Allocation of Frames - Thrashing - Memory-mapped Files - Allocating Kernel Memory - Other Considerations - Storage Management - File Concepts - Access Methods - Directory Structure -File System Mounting - File Sharing - Protection - Implementing File Systems -File System Structure - File System

Implementation - Directory Implementation - Allocation Methods - Free Space Management - Efficiency and Performance - Recovery.

Unit V - Secondary Storage Management & I/O Systems: Structure - Overview of Mass Storage Structure - Disk Structure - Disk Attachment - Disk Scheduling - Disk Management - Swap-Space Management - RAID Structure - Stable-Storage Implementation - Tertiary Storage Structure - I/O Systems - I/O Hardware - Application I/O interface - Kernel I/O Subsystem - Transforming I/O Requests to Hardware Operations .

Text Book:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, ninth Edition, John Wiley & Sons, 2012. ISBN 978-1-118-06333-0

Reference Books:

1. D. M. Dhamdhere, Operating Systems, Second Edition, Tata McGraw-Hill Education (India), 2009. ISBN 978-0-07-295769-3.
2. Achyut S. Godbole Operating Systems With Case Studies in Unix Netware Windows NT, Tata McGraw-Hill, 2005. ISBN: 007059113X, 9780070591134.
3. Andrew S. Tanenbaum, Modern Operating Systems, Fourth Edition, Prentice Hall, 2015. ISBN-10: 013359162X
4. Pramod Chandra P. Bhatt, An Introduction to Operating Systems: Concepts and practice, PHI Learning Pvt. Ltd., 2003. ISBN: 8120323068, 9788120323063.
5. Paul J. Deitel, David R. Choffnes, Operating Systems, Third Edition, Prentice Hall, 2007ISBN: 9788131712894, 8131712893
6. Colin Ritchie Operating Systems Incorporating UNIX and Windows: Incorporating UNIX and Windows, Fourth Edition, Cengage Learning EMEA, 2003. ISBN: 0826464165, 9780826464163.

17CS2014 JAVA PROGRAMMING LAB

Credits: 0:0:2

Co-requisite: 17CS2017 Programming in Java

Course Objectives:

Enable the student to

- demonstrate the programming concepts of Java.
- apply the object oriented concepts to create stand-alone applications.
- design and develop GUI applications using Abstract Window Toolkit (AWT) and Event Handling.

Course Outcomes:

The student will be able to

- describe the fundamentals of Java programming concepts.
- give examples that exposes the analytical skills on problem solving.
- write real time application using appropriate object oriented concepts and advance features of Java.
- examine streams by read and write data to and from the file system and network.
- design the user interface of the application and handle the events by using AWT components.
- predict the exception occurrence on the code and handle it efficiently.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD / Director and notify it at the beginning of each semester.

17CS2015 NETWORKING LAB

Credits: 0:0:2

Co-requisite: 17CS2004 Computer Networks

Course Objectives:

Enable the student to

- design and troubleshoot networking topologies.
- simulate various routing and switching protocols and wireless communication technologies.

Course Outcomes:

The student will be able to

- list the various command line interface networking tools.
- summarize the working of application layer protocols.

- illustrate the operation of static and dynamic routing protocols.
- experiment intra and inter VLAN routing concepts.
- devise an addressing scheme for network design.
- compare IPV4 and IPV6 functionalities.

The faculty conducting the Laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2016 PRINCIPLES OF COMPILER DESIGN

Credits: 3:0:0
Pre-requisite: 17CS2021 Theory of Computation

Course Objectives:
Enable the student to
- define and describe various concepts of language translation and compiler design.
- develop an awareness of the function and complexity of modern compilers.
- design and create a tiny compiler.

Course Outcomes:
The student will be able to
- list and define various stages of compiler.
- select and use standard tools and techniques in different stages of compiler design.
- illustrate various algorithms of different phases of compiler design.
- compare and contrast various methods for implementing the phases of a compiler.
- design and construct different phases of the compiler.
- evaluate and choose various compilers for different practical application development.

Unit I - Introduction to Compiler and Lexical Analysis (scanner): The Structure of a compiler- Regular Language - Finite Automata - Regular Expression - Regular Expression to Finite Automata- Lexical-Analyzer Generator (LEX).
Unit II - Syntax Analysis (Parser): Context-Free Grammar - Top-Down Parsing - LL(1) Grammar - Bottom-Up Parsing - LR Parsers - Parser Generator (YACC).
Unit III - Semantic Analysis and Run-time environment: Syntax Directed Definition - Evaluation Orders for SDD's - Syntax Directed Translation Schemes - Storage Organization - Stack Allocation of Space.
Unit IV - Intermediate Code Generation: Different Types of Intermediate Forms - Types and Declarations - Translation of Expressions -Type Checking - Control Flow.
Unit V - Code Generation and Optimization: Issue in the Design of a Code Generator - Optimization of Basic Blocks - Peephole Optimization - Principal Sources of Optimization - Data-Flow Analysis.

Text Book:
1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, Compilers: Principles, Techniques and Tools, Second Edition, Pearson Education, 2015, ISBN:9789332518667

Reference Books:
1. K.D. Cooper, and L. Torczon, Engineering a Compiler, Elsevier, 2012, ISBN: 978-0-12-088478-0
2. Dick Grone, Kees van Reeuwijk, Henri E Bal, Ceriel J H Jacobs, and Koen G Langendoen, Modern Compiler Design, John Wiley and Sons, Second Edition, 2012. ISBN: 978-1-4614-4699-6
3. Allen I. Hollub, Compiler Design in C, PHI Learning, 2009. ISBN: 978-8120307780
4. David Galles, Modern Compiler Design, Pearson Education 2009, ISBN-10:8131709418

17CS2017 PROGRAMMING IN JAVA

Credits: 3:0:0

Course Objectives:
Enable the student to
- understand the java programming constructs.
- apply the object oriented concepts to create stand-alone applications.

- develop platform independent applications using java class libraries.

Course Outcomes:

The student will be able to

- identify the necessary attributes and methods of an object, hierarchical classification of classes, and handle necessary exceptions.
- infer object oriented programming constructs, control statements and java library.
- show proficiency in debugging.
- model prototype for the real time application.
- develop desktop application using multi-threading, collections, IO concepts, GUI to solve real-time problems.
- design distributed applications using network concepts to solve distributed collaborative problems.

Unit I - Introduction to Java and control statements: The History and evolution of Java - An Overview of Java - Data Types, Variables and Arrays - Operators - Control Statements.

Unit II - Class, Inheritance, Package, Interface and Exception handling: Introducing Classes - A Closer look at Methods and Classes - Inheritance - Packages and Interfaces - Exceptions Handling.

Unit III - Multithreading, Enumeration, Autoboxing, Annotation, Lambda Expressions and Collections: Multithreaded Programming - Enumerations - Autoboxing and Metadata -Lambda Expressions - The Collections Framework.

Unit IV - String handling, Input/output, and Networking: String Handling - Input/Output: Exploring java.io - Networking.

Unit V - Event handling, Introducing GUI Programming with Swing: Event Handling - Layout Managers - Introducing Swing - Exploring Swing - Introducing Swing Menus**.**

Text Book:

1. Herbert Schildt, Java - The Complete Reference, McGraw-Hill, Ninth Edition, Oracle Press, 2014, ISBN 13: 978-0-07-180856-9.

Reference Books:

1. Harvey M. Dietel, Java How to Program, Ninth Edition, Prentice Hall, 2012. ISBN 978-0-13-257566-9.
2. Kathy Sierra, Bert Bates, Head First Java, Second Edition, O'Reilly Media, 2005, ISBN: 10-0596004656, ISBN-13:9780596004651.
3. Bruce Eckel, Thinking in Java, Fourth Edition, Prentice Hall, 2006, ISBN: 978-0131872486.
4. Ken Arnold, James Gosling, David Holmes, The Java Programming Language, Fourth Edition, Prentice Hall Professional Technical Reference, 2005, ISBN-13:9780321349804
5. E. Balagurusamy, Programming with Java: A primer, Third Edition, McGraw Hill Education; Fifth edition, 2014.ISBN-13**:** 978-9351343202

17CS2018 SOFTWARE ENGINEERING

Credits: 3:0:0

Course Objectives:

Enable the student to

- implement the verification and validation techniques.
- understand and implement requirement dictation process.
- learn analysis modelling and specification.

Course Outcomes:

The student will be able to

- describe all the software life cycle models.
- identify the various software requirements in a system and to validate them.
- apply the various architectural design methods.
- analyse various testing strategies in a system.
- categorize the various quality measurements for a software system.
- explain various phases of software project management.

Unit I - Software Process and Process Management: Introduction to Software Engineering: Software Process, Perspective and Specialized Process Models - Software Project Management: Estimation - LOC and FP Based Estimation, COCOMO Model - Project Scheduling - Scheduling, Earned Value Analysis - Risk Management.
Unit II - Requirements Analysis and Specification: Software Requirements-Functional and Non-Functional, User requirements, System requirements, Software Requirements Document - Requirement Engineering Process: Feasibility Studies, Requirements elicitation and analysis, requirements validation, requirements management-Classical analysis: Structured system Analysis, Petri Nets- Data Dictionary.
Unit III - Software Design: Design process - Design Concepts-Design Model- Design Heuristic - Architectural Design - Architectural styles, Architectural Design, Architectural Mapping using Data Flow- User Interface Design: Interface analysis, Interface Design -Component level Design: Designing Class based components, traditional Components.
Unit IV - Testing and Implementation: Software testing fundamentals - Internal and external views of Testing-white box testing - basis path testing-control structure testing-black box testing- Regression Testing - Unit Testing - Integration Testing - Validation Testing - System Testing and Debugging - Software Implementation Techniques: Coding practices-Refactoring.
Unit-V - Project Management: Estimation - FP Based, LOC Based, Make/Buy Decision, COCOMO II - Planning - Project Plan, Planning Process, RFP Risk Management - Identification, Projection, RMMM - Scheduling and Tracking -Relationship between people and effort, Task Set & Network, Scheduling, EVA - Process and Project Metrics.

Text Book:

1. Roger S. Pressman, "Software Engineering - A Practitioners Approach", Seventh Edition, Mc Graw-Hill International Edition, 2010, ISBN: 9780071267823, 0071267824.

Reference Books:

1. Ian Sommerville, "Software Engineering", 9th Edition, Pearson Education Asia, 2011, ISBN: 9788131762165, 8131762165.
2. Rajib Mall, "Fundamentals of Software Engineering", Third Edition, PHI Learning Private Limited, 2009, ISBN: 9788120338197, 8120338197.
3. Pankaj Jalote, "Software Engineering, a Precise Approach", Wiley India, 2010, ISBN: 9788126523115, 8126523115.

17CS2019 SYSTEM SOFTWARE

Credits: 3:0:0

Course Objectives:
Enable the student to

- view some of the major tasks of the system software of a computer system.
- understand internal working of the hardware and software interface of a typical system.
- learn about the working of assembler, loaders, and macro-processors.

Course Outcomes:
The student will be able to

- list different system architectures like SIC, CISC and RISC.
- explain algorithm and data structures for assembler.
- choose different features of loader and assembler.
- examine the object program.
- comply macros in assembler.
- select different system software for practical applications.

Unit I – Introduction to System Software: Introduction - System Software and Machine Architecture - The Simplified Instructional Computer (SIC) - Traditional (CISC) Machines - RISC Machines.
Unit II - Assemblers: Basic assembler functions: A simple SIC assembler - Assembler algorithms and data structures - Machine dependent assembler features: Instruction formats and addressing modes - Program relocation - Machine independent assembler features: Literals - Symbol defining statements - Expressions - Program Blocks - Control Sections and Program Linking -One Pass Assembler and Multi pass Assemblers - Implementation examples: MASM assembler.

Unit III - Loaders and Linkers: Basic Loader functions: Design of an Absolute Loader - A Simple Bootstrap Loader. Machine dependent Loader features: Relocation - Program Linking -Algorithm and Data Structures for Linking Loader. Machine-independent Loader features: Automatic Library Search - Loader Options. Loader design options: Linkage Editors -Dynamic Linking - Bootstrap Loaders. Implementation examples: MSDOS linker.
Unit IV - Macro processors: Basic Macro Processor functions: Macro Definition and Expansion - Macro Processor Algorithm and data structures. Machine-independent Macro Processor features: Concatenation of Macro Parameters - Generation of Unique Labels - Conditional Macro Expansion - Keyword Macro Parameters - Macro Processor Design Options - Recursive Macro Expansion - Algorithm - General Purpose Macro Processors - Macro Processing within Language Translators - Implementation examples: MASM Macro Processor - ANSI C Macro language.
Unit V - Other System Software: Database Management System: Basic concepts of a DBMS Level - Levels of a data description - Use of a DBMS. Text editors: Overview of Editing Process - User Interface - Editor Structure. Interactive Debugging systems: Debugging functions and capabilities - Relationships with Other parts of the system - User Interface Criteria.

Text Book:

1. L. Beck, System Software, An Introduction to System Programming, Addison Wesley, Third Edition 2007. ISBN: 978-81-7758-555-1

Reference Books:

1. D. M. Dhamdhere, Systems Programming and Operating Systems, Tata McGraw-Hill Company, 2009. ISBN: 9780074635797.
2. John J. Donovan, Systems Programming, Tata McGraw Hill-Edition, 2009. ISBN: 9780074604823.
3. D. M. Dhamdhere, Operating Systems: A Concept-based Approach, Third Edition, Tata McGraw-Hill, 2012. ISBN 9781259005589.

17CS2020 SYSTEM SOFTWARE AND COMPILER LAB

Credits: 0:0:2
Co-requisite: 17CS2016 Principles of Compiler Design

Course Objectives:
Enable the student to

- develop skills to design various phases of compiler construction.
- design the simulation of loader, assembler, and macro processor.
- gain knowledge in the internal details of various modern compilers.

Course Outcomes:
The student will be able to

- recognize various methods for representing the pattern of tokens.
- identify the pros and cons of using various compiler design techniques.
- choose the suitable compiler construction tools like Lex and Yacc.
- examine and analyze the working of various system software.
- design and construct different phases of compiler.
- select the appropriate compiler or interpreter for real time application development.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

17CS2021 THEORY OF COMPUTATION

Credits: 3:1:0
Course Objectives:
Enable the student to

- describe the logical and mathematical foundations of computer science.
- design and construct various abstract models of computation.
- apply the mathematical concepts to solve computational problems.

Course Outcomes:
The student will be able to

- define and use abstract models of various computational models such as finite automata, push-down automata and Turing Machines.

- classify various computational models based on their expressive power.
- solve various computational problems using the mathematical models.
- analyse and differentiate the capabilities of various models.
- design various mathematical models for any computable problems.
- explain and justify various theorems and select appropriate mathematical models of computers.

Unit I - Finite Automata and Regular Languages: Introduction to Finite Automata - Regular Languages and Regular Grammars - Properties of Regular Language.
Unit II - Context Free Grammars and Languages: Context Free Languages - Context Free Grammars and their Parse Trees - Simplification of Context Free Grammars and Normal Forms.
Unit III - Push Down Automata: Definition and Languages of a PDA - Deterministic and Nondeterministic Pushdown Automata - Equivalence of PDA's and CFG's - Properties of Context Free Languages.
Unit IV - Turing Machines: Definition of a Turing Machine - Turing Machine as Language Acceptor and Transducers - Variations of Turing Machines - Linear Bounded Automata.
Unit V - Undecidability: Recursive And Recursively Enumerable Languages -Undecidable Problems about Turing Machines - Post's Correspondence Problem - Overview of Computational Complexity.

Text Book:

1. Peter Linz, An Introduction to Formal Languages and Automata, Fifth Edition, Jones and Bartlett Learning, 2011. ISBN-978-93-808-5328-4

Reference Books:

1. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, Third Edition, Pearson, 2008. ISBN-978-81-317-2047-9
2. Kamala Krithivasan, Rama R, Introduction to Formal Languages, Automata Theory and Computation, Pearson, 2009. ISBN-978-81-317-2356-2
3. Christos H. Papadimitriou, Harry R. Lewis, Elements of the Theory of Computation, Second Edition, PHI Learning, 2009. ISBN-978-81-203-2233-2
4. John C. Martin, Introduction to Languages and The Theory of Computation, Third Edition, Tata McGraw-Hill Education, 2007. ISBN-978-00-706-6048-9
5. Michael Sipser, Introduction to the Theory of Computation, Second Edition, Cengage Learning, 2012. ISBN-978-81-315-1750-5

17CS2022 UNIX ARCHITECTURE

Credits: 3:0:0

Course Objectives:
Enable the student to

- enumerate the internal working of Unix Kernel, its data structures and system calls.
- describe the concepts of memory architecture, interrupts and exceptions, and system start-up.
- illustrate inter-process communication.

Course Outcomes:
The student will be able to

- describe the architecture and features of UNIX Operating System.
- identify UNIX commands for file handling and process control.
- discover the context of a process and system calls that manipulates and control process context.
- illustrate data structure of file, process and system calls for file subsystem and process control subsystem.
- develop the internal algorithms of kernel.
- appraise the various Inter-process communication methods.

Unit I - UNIX Operating System: History - Essential Unix commands - vi editor -shell programming - Introduction to Kernel: Architecture of the UNIX operating system - introduction to system concepts. The buffer-Reading and writing disk blocks - advantages and disadvantages of the buffer cache.
Unit II - Internal Representation of Files and File System Calls: The internal representation of Files - conversion of a path name to an INODE -Super block - INODE assignment to a new file. System calls for the file system - File creation - creation of special files - change directory change root - Change owner and change mode - Stat and fstat - pipes

Unit III - Process Control and Scheduling: The structure of processes - Process Control - the user ID of a process - Changing the size of a process - Process Scheduling and time: process scheduling - System calls for time- clock.
Unit IV - Memory Management Polices: Swapping - Demand Paging - The I/O subsystem: driver interfaces - Disk drivers. Terminal driver's stream.
Unit V - Inter Process Communication: Process Tracing - System V IPC - Network Communications - Sockets.

Text Book:

1. Maruice J. Bach, The design of the UNIX operating system, First Edition Reprint, Prentice Hall of India, publication year-2012. ISBN-13: 978-81-203-0516-8, ISBN-10: 8120305167.

Reference Books:

1. Prabhat K. Andleigh, UNIX System Architecture, First Edition Reprint, Prentice Hall, 2005. SBN: 780139498435.
2. Kay A. Robbins, Steve Robbins, UNIX Systems Programming, First Edition Reprint, Pearson Education, 2005. ISBN-13: 9788131722084
3. Yashwant Kanetkar, UNIX Shell Programming, First Edition Reprint, BPB Publications, 2005, ISBN-13: 978-8170297536.
4. Kenneth Rosen, Douglas Host, James Farber, Richard Rosinki, UNIX-The Complete Reference, Second Edition, McGraw- Hill, 2006. ISBN: 9780071706988.
5. Prabhat K. Andleigh, UNIX System Architecture, First Edition Reprint, Prentice Hall, 2005. ISBN: 9780139498435.
6. Ed Dunphy, The UNIX Industry: Evolution, Concepts, Architecture, Applications and Standards, QED Technical Pub, 2007. ISBN: 089435390X, 9780894353901.

17CS2023 UNIX AND LINUX LAB

Credits: 0:0:2
Co requisite: 17CS2022 Unix Architecture

Course Objectives:
Enable the student to

- describe different UNIX commands.
- demonstrate the programming skills using shell script.
- illustrate inter-process communication using C/C++.

Course Outcomes:
The student will be able to

- identify basic Unix/Linux commands.
- select and apply UNIX commands on a standard UNIX/LINUX Operating system.
- demonstrate shell programming on UNIX OS.
- experiment UNIX system calls using library routines.
- create processes and demonstrate file operations.
- explain inter-process communication in the UNIX programming environment.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2024 WEB TECHNOLOGY

Credits 3:0:0

Course Objectives:
Enable the student to

- use HTML5 and CSS3 standards in the latest versions of modern browsers to design Web applications.
- provide knowledge in the design and development of interactive web applications integrated with database.
- utilize open source web application framework and its associated plugins to enable responsive web application development.
- provide latest skills and project-based experience in emerging technologies needed for entry into web development careers.

Course Outcomes:
The student will be able to

- select appropriate design standards for designing attractive web pages.
- identify latest client and server side technologies for creating interactive data driven websites.
- apply properties and methods which facilitate dynamic application development.
- model dynamic web applications using suitable latest server-side technologies integrated with database.
- create fully functional web applications that incorporates planning, designing, coding, testing, and publishing to a web server.
- attach rich interactive features for web applications using MVC based framework.

Unit I - HTML5: Introduction - Structure of the document-Working with Text, Organizing Text -Links and URLs - Working with Images, Colors, Canvas - Working with Forms - Interactive elements and Multimedia - Implementing the advanced features of HTML5.
Unit II - Cascading Style Sheet 3: Backgrounds and color gradients - Fonts and Text Styles using CSS - List Styles and Table Layouts using CSS - Creating Boxes and Columns Using CSS - Positioning and Layouts - Effects, frames and Controls in CSS - Overview of Bootstrap.
Unit III - JavaScript: Overview of JavaScript - JavaScript Functions, Events, Image Maps, and Animations - JavaScript Objects - Working With Browser Objects - Working With Document Object - Document Object Model - Validation, Errors, Debugging, Exception Handling, and Security.
Unit IV - PHP: Introduction to Dynamic Web Content - Setting up a Web Development Server - Structure of PHP Expression and Control Flow in PHP - PHP Functions and Objects - PHP Arrays - Form validation and handling in PHP - Cookies, Sessions and Authentication - Accessing a database using PHP and MYSQL.
Unit V - AngularJS: Introducing AngularJS - Starting Out with AngularJS - Basic AngularJS Directives and Controllers - AngularJS Modules - Creating Our First Controller - Working with and Displaying Arrays - Working with ng-repeat - Working with ng-model - Working with Forms - Form Validation and States - Nested Forms with ng-form - Working with Filters - Routing Using ngRoute - Routing in a Single-Page Application.

Text Books:

1. DT Editorial Services, HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, Ajax, PHP and jQuery, Dreamtech Press, 2nd Edition, 2015, ISBN-13: 9789350040959.
2. Robin Nixon, Learning PHP, MySQL and JavaScript, O'Reilly Media, Inc., 3rd Edition 2014, ISBN: 978-1-4919-4946-7| ISBN 10:1-4919-4946-5.
3. Brad Green, Shyam Seshadri, AngularJS: Up and Running, O'Reilly Media, Inc., September 2014, ISBN: 9781491901946.

Reference Books:

1. Zak Ruvalcaba, Murach's HTML5 and CSS3, Mike Murach & Associates, 3rd Edition, 2015, ISBN: 1890774839 | 9781890774837.
2. David Sklar, Adam Trachtenberg, PHP Cookbook: Solutions & Examples for PHP Programmers, O'Reilly Media, 3rd Edition, 2014, ISBN: 978-1-4493-6375-8 | ISBN 10:1-4493-6375-X
3. Stephen Radford, Learning Web Development with Bootstrap and AngularJS, Packt Publishing Ltd., May 2015, ISBN 978-1-78328-755-0.

17CS2025 WEB TECHNOLOGY LAB

Credits: 0:0:2
Co-requisite: 17CS2024 Web Technology
Course Objectives:
Enable the student to

- design dynamic websites with good aesthetic sense using HTML5 and CSS3.
- analyze problems as well as identify the technologies appropriate to their solutions.
- develop hands on experience using latest technologies integrated with database such as PHP and Ajax.
- improve basic skills in analyzing the usability of a web site.

Course Outcomes:
The student will be able to

- select latest standards like HTML5 for designing attractive static web pages and separate design from content using CSS3.

- identify a technology currently available in the market to design responsive websites.
- apply the client-side scripting techniques required to develop dynamic websites.
- compare the latest server-side technologies for synchronous and asynchronous data transfer between client and server.
- design and develop web applications integrated with database using server-side scripting techniques like PHP, Ajax and MySQL.
- choose data formats like XML and JSON for the delivery of electronic information.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/ Director and notify it at the beginning of each semester.

17CS2026 AD HOC NETWORKS

Credits: 3:0:0

Course Objectives:
Enable the student to
- understand the basic concepts of Ad Hoc networks
- compare the effectiveness of different routing protocols
- evaluate the performance of Multicast Routing Protocols

Course Outcomes:
The student will be able to
- define the fundamentals of Ad hoc networks
- identify the performance characteristics of Ad hoc routing protocols.
- solve the energy issues in Ad hoc networks.
- appraise the routing protocols and apply them in building Ad hoc networks.
- explain the principles of transport protocols in Ad hoc networks.
- evaluate the methods for multicast routing.

Unit I - Introduction to Ad Hoc Networks: Model of Operation –Proactive Vs Reactive protocols - Multicast - Commercial applications of Ad hoc networking –Personal Area Networks and Bluetooth - Scalability –Issues in Ad hoc Wireless Networks - IEEE 802.11 Standard**.**
Unit II - MAC protocols for Ad hoc wireless networks: Multiple Access Techniques - Issues in designing MAC protocol - Design goals –Classification of MAC protocols –Contention based protocols - Contention based protocols with reservation mechanisms –Contention based protocols with scheduling mechanisms - MAC that use directional antennas - Other MAC protocols.
Unit III - Routing Protocols for Ad hoc network: Design issues - Classification of routing protocols - Source Driven Routing - Table Driven Routing and Types - Updating routes in wireless networks–Static and Dynamic routing Performance Metrics– Multicast routing - Classification of Multicast Routing Protocols - Proactive and Reactive types.
Unit IV - Transport protocols: Design issues - Classification - TCP Over Ad hoc networks - Application controlled transport protocol - Ad hoc transport protocol - Versions of TCP - TCP Reno - TCP Veno - TCP Vegas.
Unit V - Ad hoc Security and QoS: Issues and challenges in security provisioning - Security attacks - Secure routing in Ad hoc networks –Issues and Challenges - Classifications of QoS solutions– Smart Batteries and Battery Characteristics– Effects of Beaconing on Battery Life.

Text Books:
1. Charles .E. Perkins, AdHoc Networking ,Pearson Education,2008, ISBN-10: 0321579070
2. Siva Ram Murthy. C and Manoj. B.S, AdHoc Wireless Networks: Architectures and protocols, Prentice Hall PTR, 2004, ISBN 0132465698

Reference Books:
1. C.K.Toh, Ad Hoc Mobile Wireless Networks-Protocols and Systems, Pearson Education, 2007, ISBN 0132442043
2. Sudip Misra, Issac Woungang, Subhas Chandra Misra, Guide to Wireless AdHoc Networks, Springer Verlag London ltd,2009, ISBN 1848003285

3. Jochen Schiller, Mobile Communications, second edition, Addison Wesley Publishers, 2008, ISBN 8131724263

17CS2027 BUSINESS INTELLIGENCE

Credits: 3:0:0

Course Objectives:
Enable the student to

- provide enhanced knowledge on business Intelligence and the techniques for gathering, storing, analyzing, and Reporting.
- impart Knowledge about decision support system, online analytical processing (OLAP), statistical analysis, forecasting, and data mining.

Course Outcomes:
The student will be able to

- identify the tools, technology and processes associated with Business Intelligence framework.
- describe the difference between Transaction Processing and Analytical applications and the need for Business Intelligence.
- demonstrate understanding of Data Warehouse implementation methodology and project life cycle.
- analyze a given business scenario, identify the metrics, indicators and make recommendations to achieve the business goal.
- design an enterprise dashboard that depicts the key performance indicators which helps in decision making.
- summarize the report of an application using open source Adhoc reporting tools.

Unit 1: Introduction to Business Intelligence: Effective decision Making-Keys to Effective Decision making Business Intelligence and Microsoft SQL Server 2008-What Business Intelligence can do for you-Business Intelligence at many levels-Maximum Miniatures-Building the foundation Transactional data-The Data Mart-Snowflakes, Stars and Analysis Services-The Business Intelligence Development studio-T he SQL Server Management Studio.
Unit II - Defining Business Intelligence Structures: Data Mart - Designing a Data Mart-Table Compression-The Benefits of Integration-Integration Services-Package items
Unit III - Analyzing Cube Content: Building in Analysis Services-Measures-Dimensions-MDX Scripting MDX Queries-The Basic MDX Select Statement-Additional tools for Querying-Additional Dimensions-Operators-Functions.
Unit IV - Mining: What is Data Mining? -Data Mining Algorithms-Data Mining Structure- Mining Model Viewer-Mining Accuracy Chart-Mining Model Prediction-Data Mining Extensions-Special Delivery.
Unit V - Delivering: Reporting Services-Report Service Architecture-Creating Reports using the Tablix Data Region-Report Manager-Managing Reports on the Report Server-Adhoc reporting.

Text Book:

1. Brain Larson, Delivering Business Intelligence with Microsoft SQL server 2016, Fourth Edition, McGraw Hill,2016,ISBN-13: 978-1259641480

Reference Books:

1. Lynn Langit, Foundations of SQL Server 2005 Business Intelligence ,Apress 2007, ISBN 978-1590598344
2. Paul Turley, Thiago Silva, Bryan C. Smith, Ken Withee , Professional Microsoft SQL Server 2008
3. Reporting Services , John Wiley and Sons, 2011, ISBN:1118059549, 9781118059548,
4. Philo Janus, Guy Fouche , Pro SQL Server 2008 Analysis Services,: Apress, 2010, ISBN:1430219955.

17CS2028 C# AND .NET PROGRAMMING

Credits: 3:1:0

Course Objectives:
Enable the student to

- understand core programming constructs in C# and .NET platform.
- create windows and web applications along with data access methods.
- develop advanced controls in ASP .NET.

Course Outcomes:
The student will be able to

- describe the fundamentals of C# programming constructs with .NET Framework.
- extend and debug variety of applications that run on .NET framework.
- use the features of C# in .NET applications.
- illustrate .NET applications with relational database and variety of data sources for efficient data access.
- design advanced controls to build more elegant, maintainable and scalable ASP.NET applications.
- predict and handle exceptions to prevent application crashes.

Unit I - C# and .NET Basics: .NET Architecture - C# Basics - Objects and Types - Inheritance - Arrays.
Unit II - Advanced Features: Operators and Casts - Delegates and Events - Strings and Regular Expressions - Collections.
Unit III - Base Class Libraries: Memory Management and Pointers - Reflection - Errors and Exceptions - Assemblies - Threading and Synchronization.
Unit IV - Data Access: Fast Data Access - Windows - Data Binding.
Unit V - Presentation: ASP.NET Pages - ASP.NET Development - ASP.NET AJAX.

Text Book:

1. Christian Nagel, Bill Evjen, Jay Glynn, Morgan Skinner, Karli Watson, Professional C# 2008, Wiley Publishing, Inc., 2008. ISBN: 978-8-126-51627-8

Reference Books:

1. Andrew Troelson, Pro C# 2010 and the .NET 4 Platform, Apress, 2010. Fifth Edition, ISBN: 978-1-4302-2549-2.
2. Kogent Solutions, C# 2012 Programming: Covers .NET 4.5 Black Book, Dreamtech Press, Platinum Edition, 2013. ISBN: 978-9351192107
3. Don Gosselin, ASP .NET Programming with C# and SQL Server, Cengage Learning, 2009, ISBN1423903242

17CS2029 C# AND .NET PROGRAMMING LAB

Credits: 0:0:2
Co–requisite: 17CS2028 C# and .Net Programming
Course Objectives:
Enable the student to

- demonstrate the programming concepts of C# and .NET.
- develop windows applications along with data access methods.
- design real time web applications.

Course Outcomes:
The student will be able to

- describe the fundamentals of C# programming constructs with .NET Framework.
- express the concepts of C# in variety of applications.
- apply the knowledge of object oriented programming concepts.
- model the user interface for windows and web based applications.
- develop the real time .NET applications with relational database.
- predict and handle exceptions to prevent application crashes.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD / Director and notify it at the beginning of each semester.

17CS2030 COMPUTER GRAPHICS

Credits: 3:0:0
Course Objectives:
Enable the student to

- understand the fundamental idea of graphics and animation.
- learn the concept of principles of 2D graphics, 3D graphics, visible surface determination.
- develop skills in the design and analysis of practical engineering problems through the integration of geometric modeling, and computer graphics.

Course Outcomes:
The student will be able to

- identify the importance of learning Computer Graphics techniques.
- describe the various applications of Computer Graphics.
- demonstrate the working of input/output devices.
- test and implement line drawing algorithm, circle and ellipse drawing algorithm.
- explain the importance of basic 2-Dimensional and 3-Dimensional transformations.
- compare and contrast various color models.

Unit I - Basic principles of two dimension graphics: Raster versus vector graphics-The first java 2D program-Basic geometric objects-Geometric transformations-Homogenous coordinates-Applications of transformations-Geometric transformations in java 2D-Animation and movements based on transformations- Interpolators for continuous changes- implementations of interpolators in Java 2D-Single or double precision.
Unit II - Drawing lines and curves: Lines and pixel graphics-The midpoint algorithm for lines-Structural algorithms-Pixel densities and line styles-Line clipping-Midpoint algorithm for circles-Drawing arbitrary curves-Antialiasing-Drawing thick lines-Filling areas-Buffered images in java 2D-Displaying text-Text in java 2D-Grey images and intensities-Colour Model-Colour Interpolation with java 2D.
Unit III - Basic principles of three-dimensional graphics: Geometric transformations-The scene graph-Elementary geometric objects in java 3D-The scene graph in java 3D- Animations and moving objects- Projections in Java 3D-Modelling Three dimensional objects-Three Dimensional objects and their surfaces-Topological notions-Modelling techniques-Surface Modeling with polygons in java 3D-importing geometric objects in to java3D-Parametric curves and freedom surfaces normal vectors for surfaces.
Unit IV - Visible surface determination: Clipping volumes-Algorithms for visible surface determination-Image precision techniques-Priority algorithms-Illumination and shading- Light sources-Light sources in java 3D-Reflection-Shading in java 3D-Shading-ShadowsTransparency-Textures-Textures in java 3D-The radiosity model-Ray tracing.
Unit V - Special effects and virtual reality: Fog and particle systems- Fog in Java 3D- Dynamic surfaces-Interaction-Interaction in Java 3D-Collision detection-Collision detention in Java 3DSound effects-Sound effects in Java 3D- stereoscopic viewing

Text Book:

1. Frank Klawonn, Introduction to Computer Graphics Using Java 2D and 3D, second edition, Springer, 2012, ISBN: 978-1-84628-847-0.

Reference Books:

1. Rick Parent, Computer Animation Algorithms and Techniques, Newnes publishers, 2012, ISBN:0124158420, 9780124158429
2. James D.Foley, et al,Computer Graphics Principles and Practices, Addison Wesley, 1997, ISBN: 0321210565, 9780321210562
3. F.S.Hill, Stephen Kelley,Computer graphics using Open GL, Pearson Prentice Hall,2007,ISBN—81-203-2813-2.
4. Peter Shirley, et al, Fundaments of Computer Graphics, fourth edition, CRC Press, 2016, ISBN: 1498785905, 9781498785907
5. Issac Victor Kerlow, The Art of 3D Computer Animation and Effects, John Wiley, 2004, ISBN:0471430366.

17CS2031 COMPUTER GRAPHICS AND APPLICATIONS LAB

Credits: 0:0:2

Course Objectives:
Enable the student to

- understand the concepts underlying modern Computer Graphics and Animation.
- create graphical scenes using open graphics library suits.
- create awesome multimedia presentation/Game/Project.
- To understand lighting and rendering a scene.

Course Outcomes:
The student will be able to

- describe the process of making 2D and 3D animation using computer graphics.
- convert the sketches, mock-ups and designs on paper into interactive graphics applications using suitable tools.
- apply the knowledge of graphics primitives in designing powerful multimedia presentation/Animation.
- model an interactive 2D multimedia animation with computer graphics.
- create 2D animations using one or more graphics application programming interfaces.
- predict how to model different objects using splines, NURBS, polygons, subdivision surfaces, and tools.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2032 DATABASE ADMINISTRATION

Credits: 3:0:0

Course Objectives:
Enable the student to

- provide an overview of database architecture.
- impart knowledge on database creation and user management.
- introduce the concepts of database backup and recovery.

Course Outcomes:
The student will be able to

- recall and relate the logical and physical architectural design of a database.
- identify and analyse the role of database administrator on designing the database
- demonstrate creation and maintenance of the database.
- examine the privacy and security issues in user management
- plan various possibilities of storage management by assessing the requirements.
- explain the consistency issues while performing database backup and recovery.

Unit I - Database Architecture: Getting Started with the Oracle Architecture -An Overview of Databases and Instances - Oracle Logical Storage Structures - Oracle Logical Database Structures- Oracle Physical Storage Structures - Oracle Memory Structures - Backup/Recovery Overview.
Unit II - Database Creation: Deletion - Oracle Installation Tablespaces. Planning and managing Tablespaces - Tablespace Architecture**.**
Unit III - Physical Database Layouts and Storage Management: Traditional Disk Space Storage. Common Space Management Problems - Oracle Segments, Extents, and Blocks.
Unit IV - Monitoring Space Usage: Data Dictionary Views and Dynamic Performance Views - Managing Transactions with Undo Tablespaces - Transaction Basics - Undo Basics - Managing Undo Tablespaces - Flashback Features. Database Security and Auditing - User Management -Database Authorization Methods - Auditing.
Unit V - Backup and Recovery Options: Logical Backups - Physical Backups - Using Data Pump Export and Import - Data Pump Import Options - Recovery Manager (RMAN).

Text Book:

1. Bob Bryla,KevinLoney, "Oracle Database 11g DBA Handbook", The McGraw-Hill Companies,2008,ISBN -0-07-159579-1.

Reference Books:

1. Sam R Alapatti, "Expert Oracle Database 11G Administration", Apress Publication, First Edition, 2009, ISBN-13-4302-1015-3.
2. Iggy Fernandez, "Beginning oracle Database 11g Administration from Novice to Professional",2009, ISBN-978-81-8489-216-1. 4. Kognet, "Oracle 11G Administration in simple steps" Dream Tech Press, First Edition, 2008, ISBN 10-817722-854-4, ISBN: 13-978-81-7722-854-0.

17CS2033 DESIGN PATTERNS

Credits: 3:0:0

Course Objectives:

Enable the student to

- provide an overview of the concepts, processes, and techniques associated with formal design pattern and to learn about the design pattern strategies.
- develop skills that will enable to construct different types of patterns like creational, structural and behaviour patterns.
- experience object oriented concepts in different perspective.

Course Outcomes:

The student will be able to

- describe reusable object oriented software that can be adaptable to any type of project needs.
- extend the design into coding by using programming languages like C++ and Java according to the current needs.
- illustrate the importance of systems design in solving complex problems.
- criticize the dynamic structure and behavior of a system
- relate the Design patterns and the software applications.
- select the required patterns according to given problem statements

Unit I - Introduction to design pattern and designing document editor: Introduction - Design Pattern - Smalltalk MVC - Describing Design Patterns - The Catalog - Organizing the Catalog - Pattern Solve Design Problems - Select a Design Pattern - Use Design Pattern - Design Problems - Lexi document editor - Case Study.

Unit II - Creational patterns: Abstract Factory - Builder - Factory Method - Prototype - Singleton Discussion of Creational Patterns

Unit III - Structural patterns: Structural Patterns - Adapter-Bridge - Composite - Decorator - Façade –Flyweight - Proxy - Discussion of Structural Patterns.

Unit IV - Behavioral patterns: Chain of Responsibility - Command - Interpreter - Iterator - Mediator Memento - Observer.

Unit V - Behavioral patterns and expectations: State-Strategy - Template Method - Visitor - Discussion of Behavioral Patterns - Conclusion - The Pattern Community - An Invitation - A Parting Thought.

Text Book:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vissides, Design Patterns- Elements Reusable Object Oriented Software", Twelfth Edition, illustrated, revised 2011, ISBN 978-81-317-0007-5.

Reference Books:

1. Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra. Head First Design Patterns, 2004, O'Reilly Media, ISBN 978-0-596-00712-6.
2. Wolfgang Pree, Design Patterns for Object Oriented Software Development, 1995, Addison - Wesley Publishing, ISBN 0-201-422948.
3. John Vlissides, Pattern Hatching: Design Patterns Applied, 1998, Addison-Wesley Publishing, ISBN 0-201-43293-5.

17CS2034 E-COMMERCE

Credits: 3:0:0

Course Objectives:

Enable the student to

- have awareness about role of IT in business.
- impart knowledge of basic concepts of ecommerce.
- provide in depth knowledge in security and legal issues in ecommerce.

Course Outcomes:

The student will be able to

- identify the type of ecommerce and security mechanism to be used for particular application.
- explain how to build virtual book store based on requirements.
- choose to adapt the usage of electronic payment systems.

- analyze the impact of E-commerce on business models and strategy.
- create an understanding of the foundations and importance of E-commerce
- describe Internet trading relationships including Business to Consumer, Business-to-Business, Intra-organizational.

Unit I - Introduction to E-commerce: Examples of the types of e-commerce- Some e-commerce scenario- Myths about e-commerce development and implementation- An overview of the Internet- Hypertext Transfer Protocol(HTTP)- Cookies Examples HTTP/1.1.
Unit II - Introduction to Web-Programming: Overview of HTML- Cascading Style Sheet(CSS)- Java script- Common gateway Interface(CGI)- Overview of the servlet API(example)- Relational database systems- JDBC (EXAMPLE Servlet book query, Virtual book store).
Unit III - Introduction of session tracking (shopping in VBS): Traditional session tracking techniques- The servlet session tracking API- CASE: VBS Shopping CART- Principles of private key encryption- Diffie Hellman key exchange Protocol, RSA- Message Digest, Digital signature- Authentication.
Unit IV - Introduction of IPSEC, Applications: Firewalls, different type- Secure Socket Layer(SSL)- E-retailing, Consumer oriented e-commerce- Electronic Payment System (B2C, B2B)-Introduction, Business models- Integration- Advanced Technologies of e-commerce- E-services- Introduction of different e- services- e-entertainment , action and other specialized services.
Unit V - Internet advertising: techniques and strategies- Web phishing goals ,website development methodologies- Logical user interface, testing, quality assurance- Step-by-Step Exercises for Building the VBS.- Introduction= VBS Home page design- form validation using javascript- Search engines, quick search- category, advanced search- Cart login-VBS.

Text Book:

1. Henry Chan, Raymond Lee, Tharam Dillon and Elizabeth Chang,E-Commerce Fundamentals and Applications, John Wiley and Sons Ltd., 2008.ISBN 978-81-265-1469-4.

Reference Books:

1. R Kalokota, Andrew V.Winston, Elecronic Commerce-a Managers Guide, Fourth Edition, Pearson Education, 2006. ISBN:81-780-8158-X.
2. ErfanTurban, DaveKing, JaeKyuLee, DennisViehland, Electronic Commerce-A Managerial Perspective, Fourth Edition, Pearson Education,2006, ISBN: 81-780-8362-0.

17CS2035 ENTERPRISE RESOURCE PLANNING

Credits: 3:0:0

Course Objectives:
Enable the student to

- explain the typical functionalities of ERP.
- understand the steps and activities in the ERP life cycle
- learn concepts of reengineering and how to relate it into ERP system.
- apply best business practices in ERP.

Course Outcomes:
The student will be able to

- relate business processes using process mapping techniques.
- categorize the typical functionalities of ERP.
- analyze the steps and activities in the ERP life cycle.
- relate concepts of reengineering into ERP system.
- identify and describe typical functionalities in ERP system.
- predict solution for the business needs.

Unit I - Overview of ERP: Introduction on Enterprise - Introduction to ERP-Basic Concepts of ERP-Risks and Benefits of ERP - Roadmap for successful ERP implementation.
Unit II - Introduction to ERP related technologies: BI - E-commerce and E-business and BPR - Data Mining and warehousing and OLAP - Product Life Cycle Mgt, Supply chain Mgt and Customer relationship Mgt - ERP Market place and Market place Dynamics.

Unit III - ERP-Functional Modules: Finance and Manufacturing - HR and Plant maintenance - Material and Quality Management - Marketing , sale, Distribution and Service - ERP implementation and challenges - Implementation Strategies - Life Cycle of ERP - Package Selection - ERP Project Teams.
Unit IV - Process Definition: Vendors and consultants - Contracts with vendors - Consultant and employees - Success and Failure factors of ERP implementation - Operation and maintenance of ERP - Measuring the ERP system - Maximizing the ERP system.
Unit V - Introduction to OpenERP: E-Business - ERP- Internet and WWW - Total Quality Management - Future Directions and Trends in ERP - ERP Case studies.

Text Book:

1. Alexis Leon, Enterprise Resource Planning, McGraw Hill Education, Second Edition, Thirteenth reprint 2013, ISBN -13:978-0-07-065680-2.

Reference Books:

1. Ellen F. Monk, Bret J. Wagner, Enterprise Resource Planning, Third Edition, Cengage Learning EMEA, 2009.
2. Mary Sumner, Enterprise Resource Planning, Pearson Education India, 2006.
3. Liisa von Hellens, Sue Nielsen, JenineBeekhuyzen, Qualitative Case Studies on Implementation of Enterprise Wide Systems, Idea Group Inc (IGI), 2005
4. Gregory R Moss, Working with OpenERP, Packt Publishing Ltd, 2013, ISBN 1782163816, 9781782163817.

17CS2036 ETHICS IN INFORMATION TECHNOLOGY

Credits: 3:0:0

Course Objectives:
Enable the student to

- comprehend the development and need for issues regarding social, legal, privacy and the application of computer ethics to information technology.
- acquire professional ethics, privacy, criminal conduct, property rights, free speech, access, and reliability.
- acquire policies and standards of multinational corporates.

Course Outcomes:
The student will be able to

- identify the issues of professional conduct in information technology.
- indicate the impact of the privacy laws on information security policies.
- illustrate the issues related to intellectual freedom, intellectual property and copyright law as they relate to electronic publishing.
- discriminatethe key ethical concerns of information technology.
- tell appropriate decisions around ethical issues in an array of information and technology practices.
- relate to the different national and international organizational model with intellectual ability.

Unit I - An overview of ethics: Introduction to Ethics - Ethics in the Business World-Ethics in information technology-Ethics for IT Workers and IT Users-IT Professionals-IT professional malpractice-IT Users.
Unit II - Computer and internet crime, privacy: IT Security Incidents -A major concern Implementing Trustworthy Computing - Privacy-Privacy Protection and the Law-Key Privacy and Anonymity Issues.
Unit III - Freedom of expression and intellectual property: First Amendment Rights-Freedom of Expression: Key Issues-Intellectual Property - Copyrights-Patents-Trade Secrets-Key Intellectual Property Issues.
Unit IV - Software development and the impact of information technology: Strategies to Engineer Quality Software-Key Issues in Software Development- The impact of IT on the Standard of Living and Productivity - The impact of IT on Healthcare Costs.
Unit V - Social networking, ethics of information technology organizations: Social Networking Web Site - Business Applications of Online Social Networking-Social Networking Ethical IssuesOnline Virtual Worlds-Key ethical issues for Organizations-Need for Non-traditional Workers-Contingent Workers-H-1B Workers-Outsourcing-Whistle Blowing-Green Computing-ICT Industry Code for Conduct.

Text Book:

1. George Reynolds, Ethics in Information Technology, CENGAGE Learning Fourth Edition, 2012. ISBN: 9788131518755, 8131518752

Reference Books:

1. Richard A. Spinello, Case Studies in Information Technology Ethics, Second Edition, Prentice Hall, 2003. ISBN:978-0130991508.
2. Sara Base, A Gift of Fire:social, legal, and ethical issues for computing and the Internet, Second Edition, by, Prentice Hall, 2008. ISBN: 978-0132492676
3. Tavani, H, Ethics and Technology: Ethical Issues in an Age of Information and Communication Technology, Second Edition by John Wiley and Sons 2007. ISBN:978-0471998037

17CS2037 FUNDAMENTALS OF HUMAN COMPUTER INTERACTION

Credits: 3:0:0

Course Objectives:

Enable the student to

- recognize and recall terminology, facts and principles influencing human computer interaction.
- practice a variety of simple methods for evaluating the quality of a user interface.
- use concepts and principles to explain, analyze and solve specific situations, often with the applicable concepts implicit in the setting.

Course Outcomes:

The student will be able to

- describe the fundamental design and evaluation methodologies of human computer interaction.
- identify the capabilities of both humans and computers from the viewpoint of human information processing.
- use the information sources available, and be aware of the methodologies and technologies supporting advances in HCI.
- analyze an interactive design process and universal design principles to designing HCI systems.
- plan how a computer system may be modified to include human diversity.
- assess the theories and concepts associated with effective work design to real-world application.

Unit I - Introduction to Interactive Systems: Drawing - Drawing Models and Methods - event handling - Event / Code Binding - Model / View Notification - Implementation - widgets - Types of Widgets - Model-View-Controller with Widgets.

Unit II - Layout Constraints: Multiple View Models - Review of Model-View-Controller - Managing Model Persistence - Abstract Model Widgets - Look and Feel - Interface Design Tools - Internationalization.

Unit III - Input Syntax Specification: 2D Geometry - Geometric Transformations - Cut, Copy, Paste, Drag and Drop - Undo Scripts and Versions.

Unit IV - Distributed and Collaborative Interaction: Text Input - Digital Ink - Selection - Display Space Management.

Unit V - Presentation Architecture: Web Interaction - Physical Interaction - Function Design - Evaluating Interaction.

Text Book:

1. Dan R. Olsen, Human - Computer Interaction,Cengage Learning, 2010, ISBN:978-81-315-1137-4.

Reference Books:

1. Alan J. Dix, Janet E. Finlay, Gregory D. Abowd, Russell Beale, Janet E. Finley., Human-Computer Interaction, Third Edition, Prentice Hall, 2008, ISBN:8131717038.
2. Christine Faulkner, The Essence of Human-Computer Interaction, First Impression 2011, PearsonEducation, ISBN-13: 978-0137519750.
3. Helen Sharp, Yvonne Rogers, Jenny Preece, Interaction Design: Beyond Human-ComputerInteraction, Fourth Edition, Wiley, 2015, ISBN: 1119020751.
4. Ben Shneiderman, Maxine Cohen, the user interface-Strategies for Effective Human-Computer Interaction, Fifth Edition, Pearson Education, 2010, ISBN: 813173255X.

17CS2038 FUNDAMENTALS OF JAVA PROGRAMMING

Credits: 3:0:0

Course Objectives:

Enable the student to

- learn the Java programming language fundamentals: its syntax, idioms, patterns, and styles.
- demonstrate the concept of the object oriented paradigm.
- apply the essentials of the Java class library.

Course Outcomes:

The student will be able to

- recognize the fundamental principles of object oriented application development.
- identify the fundamental programming constructs to create real time applications.
- demonstrate an interactive multitasking application services.
- breakdown the complex application requirements into small manageable abstract entities.
- assemble the various modules of real time application development.
- attach the graphical user interfaces with the application for user friendly interaction.

Unit I - Introduction to Java: History and Evolution of Java - An Overview of Java - Data Types - Variables - Arrays - Operators - Control Statements.

Unit II - Classes and Objects: Introducing Classes - A closer look at Methods and Classes - Inheritance - Packages - Interfaces.

Unit III - Exception Handling and Multithreading: Exception Handling - Multithreading - Enumeration - Autoboxing.

Unit IV - Strings and File Management: String Handling - Input/output: Exploring Java IO

Unit V - GUI Programming: Introducing Swing - Exploring Swing - Event Handling - Layout Manager

Text Book:

1. Herbert Schildt, Java: The Complete Reference, McGraw Hill Education, Ninth Edition, 2014. ISBN-13: 978-0071808552

Reference Books:

1. Paul Deitel, Harvey Deitel, Java How to Program, Pearson, Tenth edition, 2014. ISBN-13: 978-0133807806
2. Bruce Eckel, Thinking in Java, Fourth Edition, Prentice Hall, 2006. ISBN: 978-0131872486.
3. Kathy Sierra, Bert Bates, Head First Java, Second Edition, O'Reilly Media, 2005. ISBN: 10-0596004656, ISBN-13:9780596004651.

17CS2039 INFORMATION SECURITY

Credits: 3:0:0

Course Objectives:

Enable the student to

- have a thorough understanding of the issues associated with the design, provision and management of security services for information systems.
- learn the different aspects of information security, security attacks and the defense strategies used to combat them.
- establish safeguards to protect the organization's information resources from theft, abuse, misuse and any form of damage.

Course Outcomes:

The student will be able to

- define the fundamental concepts of information security.
- discuss the security terms such as authentication, authorization.
- choose various security operations to secure a network.
- identify the factors that place an internet-based information system at risk and apply this knowledge to simple case studies.
- set up procedures to secure a system against failure, theft, invasion and sabotage.

- justify and apply the concepts for administrating a small company's network.

Unit I - Information Security Overview: The evolution of information security - Security methodology - How to build a security program - Strategy and Tactics - Business Processes vs. Technical controls - Risk Analysis - Threat Definition - Types of Attacks - Security Organization - Roles and Responsibilities - Managed Security Services .
Unit II - Data Security: Authentication and Authorization - Securing Unstructured Data - Information Rights Management - Overview - IRM Technology - Storage Security Evolution - Modern storage security - Risk Remediation - Best Practices - Database Security .
Unit III - Network Security: Secure Network design - Performance - Availability - Security - Network Device Security - Network Hardening - Wireless Network Security - Radio frequency security basics - wireless vulnerabilities and mitigations - Wireless Intrusion Detection and prevention - VoIP vulnerabilities and countermeasures.
Unit IV - Computer Security: Operating system security models - Operating system models - classic security models - Reference Monitor - Securing Infrastructure Services - E-mail - Web Servers - DNS Servers - Proxy Servers - Securing Mobile Devices - Secure Application design.
Unit V - Application Security and Security Operations: Secure application design - secure development lifecycle - application security practices - Web application security - Client application Security - Remote Administration Security - Writing Secure Software - Security Operations Management - Incident Response and Forensic Analysis - Physical Security.

Text Book:

1. Mark Rhodes-Ousley, Information Security: The Complete Reference, Second Edition,McGraw-Hill Education, May 2013,ISBN: 0071784357.

Reference Books:

1. Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in Computing, Fourth Edition, Pearson Prentice Hall, 2007 ISBN-10: 0132390779 ISBN-13: 9780132390774
2. William Stallings, Cryptography and Network Security, Fourth Edition, Prentice Hall, 2006. ISBN: 81-203-3018-8.
3. Bruce Schneier, Applied Cryptography, Second Edition, John Willey and Sons, 2007. ISBN: 8126513683.
4. Michael E. Whitman, Herbert J. Mattord, Principles of Information Security, Thompson Course Technology, 2003. ISBN: 981-243- 862-9.

17CS2040 INFORMATION SECURITY LAB

Credits: 0:0:2

Course Objectives:
Enable the student to

- understand the various cryptographic techniques
- apply the different tools to detect threat types and counteract to it.
- analyse the security techniques and their performance issues.

Course Outcomes:
The student will be able to

- recall the fundamentals of network security commands.
- classify the different cryptographic algorithm.
- demonstrate the experiment on the password cracking and authentication of a system.
- analyse the information security ideas to defend against a set of widely known security attacks.
- generate the cipher text and capture secret messages using cryptographic techniques.
- estimate the practical skills and hands-on experience on security tools used in practice.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2041 INTELLIGENT SYSTEMS

Credits: 3:0:0

Course Objectives:
Enable the student to

- introduce the basic concepts of artificial intelligence.
- introduce new approaches to solve a wide variety of research-oriented problem..
- learn about the expert systems.

Course Outcomes:
The student will be able to

- match natural language into first order logic and vice versa.
- express knowledge representation techniques and problem solving strategies to common AI applications.
- prepare appropriate knowledge based rules to identify causal relationships and conditional independence of a real world situation.
- select the appropriate search method for identifying different search spaces.
- design working knowledge of reasoning in the presence of incomplete and/or uncertain information.
- interpret the learning theory for expert systems

Unit I - AI Introduction: Problems, Problem Spaces, and Search - Heuristic Search Techniques.
Unit II - Knowledge and Logics: Knowledge Representation Issues - Using Predicate Logic.
Unit III - Knowledge Rules: Representing Knowledge Using Rules - Symbolic Reasoning under Uncertainty - Statistical Reasoning.
Unit IV - Knowledge Representation: Weak Slot-and–Filler Structures - Strong Slot-and-Filler Structures - Knowledge representation Summary - planning.
Unit V - Learning: What is learning - Rote learning - Learning by taking advice - Learning in problem solving– Learning from Examples: Induction - Explanation-based Learning - Discovery - Analogy - Formal learning theory - Neural net learning and genetic learning- Expert Systems.

Text Book:

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, Third Edition, McGraw-Hill, 2009. ISBN -13: 973-0-07-008770-5. ISBN-10:0-07-008770-9.

Reference Books:

1. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition, Prentice Hall, 2010.
2. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier-Morgan Kaufmann, 2011.
3. Dan W.Patterson, "Introduction to Artificial Intelligence and Expert Systems", Prentice Hall India, 2010.
4. David Poole and Alan Mackworth," Artificial Intelligence: foundations of computational agents", Cambridge University Press, 2010.
5. Al-Dahoud Ali ,"Computational Intelligence and Modern Heuristics" , InTech , 2010

17CS2042 INTERNET ROUTING ARCHITECTURE

Credits: 3:0:0
Pre-requisite: 17CS2004 Computer Networks

Course Objectives:
Enable the student to

- understand the responsibilities of routing arbiter project, regional providers and information services.
- employ the knowledge of practical addressing, routing and connectivity issues related to network designs.
- design a network and integrate the network into the global Internet.

Course Outcomes:
The Student will be able to

- describe the essential introductory aspects of Internet Routing Architecture.
- identify routing issues using real scenarios in a comprehensive and accessible manner.
- apply effective routing design to address the routing challenges faced in the network.
- analyze to build an efficient, reliable, enterprise network accessing the Internet.

- summarize appropriate protocol attributes and routing policies for addressing various design goals.
- explain larger network and provide solutions for ISP connectivity.

Unit I - The Contemporary Internet: Evolution of the Internet - Network access point - Routing Arbiter project - The very high-speed back bone network service - NSF solicits NIS managers - Other internet registers - Internet Routing registers - ISP services and characteristics: ISP service pricing, service level agreements and technical characteristics - IP Addressing and allocation techniques: Internet Addressing - IP address space depletion.
Unit II - Routing Protocol Basics: Inter domain routing basics - Overview of routers and routing - Routing protocol concepts - Segregating world into autonomous systems - BGP version 4: How BGP works - BGP capabilities Negotiation - Multiprotocol extensions for BGP.
Unit III - Effective Internet Routing Designs: Tuning BGP capabilities - BGP peer sessions - Source of routing updates - Backdoors - The routing process simplified - controlling BGP routes - Route Filtering and attribute manipulation - BGP-4 aggregation - Redundancy, Symmetry, Load balancing - Specific scenarios.
Unit IV - Controlling Routing inside the autonomous system: Interaction of Non-BGP routers with BGP routers - BGP policies conflicting with internal defaults - Policy routing - Controlling large scale autonomous system - route reflectors - Confederations - Controlling IGP expansion - Designing stable internets: BGP stability features.
Unit V - Internet Routing Device Configuration: Configuring basic BGP functions and attributes - Configuring Effective Internet Routing Policies.

Text Book:

1. Sam Halabi, "Internet Routing Architectures" 2nd edition, 2001, Reprint 2011, Cisco Press, ISBN:978-1578702336

Reference Books:

1. Randy Zhang, Micah Bartell, "BGP Design and Implementation", 1st edition, 2003, Cisco Perss, ISBN: 978-1587051098
2. Iljitsch van Beijnum, "BGP- Building Reliable Networks with the Border Gateway Protocol" 2002, O'Reilly, ISBN: 978-0596002541
3. Christian Huitema, "Routing in the Internet", 2000, Prentice Hall, ISBN: 978-0130226471
4. Doyle, Jeff and Carroll, Jennifer, "Routing TCP/IP, Volume I", 2nd edition, 2005, Cisco Press, ISBN: 1-58705-202-4.

17CS2043 INTERNET ROUTING PROTOCOLS LAB

Credits: 0:0:2

Course Objectives:
Enable the student to
- understand the various Internet routing protocols.
- experiment routing protocols for different network topologies.

Course Outcomes:
The student will be able to
- recall the various dynamic routing protocols.
- classify the IGP and EGP routing protocols based on network capabilities.
- employ suitable addressing scheme for large scale autonomous system networks.
- experiment the behaviour of network with different route filtering policies.
- plan to build autonomous system and configure BGP protocol.
- describe the advanced functions and attributes in BGP.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2044 INTRODUCTION TO SYSTEM ADMINISTRATION

Credits: 3:0:0

Course Objectives:

Enable the student to

- describe the basics of Linux, Kernel Components and to train as a System Administrator to maintain a Linux Server.
- demonstrate Linux System Management.
- administer the Network and Secure Network Services.

Course Outcomes:

The student will be able to

- describe basic operations, linux boot procedure, initialization, and installation
- review, manage the software using RPM
- operate networking, networking services and configure secure remote access.
- analyse logs, troubleshoot linux servers and schedule tasks
- create user, group, define access privileges and configure services.
- evaluate partitions, linux file systems, perform backup and recovery.

Unit I - Exploring the Linux desktop and command line: Linux Graphical Desktop - Configuring GNOME and KDE - Core Graphical Utilities - Popular graphical Program - Exploring the Bash Shell - Shell Variables - Data Redirection - Editing Text with vi - Printing from the Command Line.

Unit II - Basic security and text processing: Understanding Users and File systems -Linux Users and Groups - File Permissions - Introducing the File System- Managing File Archives - Understanding Text Processing- Regular Expressions - Manipulating File - Using sed and awk - More advanced Text Editing.

Unit III - Process and remote access: Managing Linux Processes - Managing Memory - Scheduling Process - Controlling Access to at and crontab - Using Network Clients: Remote Login - Data Services - Networking and Diagnostic Tools.

Unit IV - Install, Configure Linux and update: Installing Linux - Reviewing Computer's Hardware - Configuring disk Space - Installing Linux using Kickstart Installations - Understanding System initialization - Hardware Initialization - Configuring Boot Loaders - init and its scripts Controlling Services - Managing Packages - Updating the System - Understanding the file system.

Unit V - User, service and backup management: Creating and managing user accounts - Complex File Permissions - User Security Issues - Configuring Networks - Configuring Linux - Networking - DHCP Server - printing services - System and Kernel Management - Linux system back up - System Logs - Exploring, Configuring and updating Kernel Components - Writing Shell Scripts - Advanced Configuration and Troubleshooting.

Text Book:

1. Nicholas Wells, The Complete Guide to LINUX System Administration, Indian Edition, Cengage Learning, 2005.

Reference Books:

1. Evi Nemeth, Garth Snyder, Trent R. Hein , Linux administration handbook, Second Edition, Pearson Education, 2007, ISBN 0-13-148004-9.
2. Tom Adelstein, Bill Lubanovic, Linux System Administration, O'Reilly Media Inc., First Edition, 2007, ISBN -13:978-0-596-00952-6.
3. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley,Unix and Linux System Administration handbook, Fourth Edition 2010, Pearson Education, ISBN 0132117363
4. Terry Collings, Kurt Wall, Red Hat Linux Networking and System Administration, Third Edition, Wiley India(P) Ltd., Reprint 2008, ISBN 81-265-0655-5

17CS2045 IPTV AND INTERNET VIDEO

Credits: 3:0:0

Course Objectives:

Enable the student to

- identify the hardware, software, and Internet technologies related to IPTV network.
- relate the key trends and drivers transforming the world of broadcast television.

- understand the various security features required for a IPTV network.

Course Outcomes:

The student will be able to

- describe the functionalities of IP Protocol and IPTV.
- classify the different types of IP Network.
- apply relevant compression schemes for the data provided.
- examine the problems in IP Network.
- categorize the quality and security features required for a IPTV and internet video.
- explain a variety of DSL technologies available.

Unit I - Introduction: The Internet Protocol, The Market for IP video -The Arguments Favor and against IP Video - Reality Check - Types of IP Video - IPTV - Internet Video.
Unit II - Constructing an IPTV Network: Constructing an Internet Video Systems-IP - The Internet Protocol - Types of IP Network - Key parts of an IP Network - Transport Protocols - Multicasting.
Unit III - Video Compression: Audio Compression - Other Compression Technologies.
Unit IV - Maintaining Video Quality and security: Video Servers - Video on demand servers -Advertising Servers - Live Streaming Servers - Encryption and Rights Management.
Unit V - DSL Technologies and Access Multiplier: Home Gateway - Multiple Televisions - How to calculate Bandwidth - Set Top Boxes - Internet Video Technologies - The Future of IP Video.

Text book:

1. Wes Simpson and Howard Greenfield, IPTV and Internet Video: Expanding the Reach of Television Broadcasting, Focal Press, 2007. ISBN: 978-0-240-81245-8.

Reference Books:

1. Howard J. Gunn, The Basics of IPTV, Intl. Engineering Consortium, 2007, ISBN 9781931695589.
2. Gerard O'Driscoll, Next Generation IPTV Services and Technologies, Wiley-Interscience,2007, ISBN: 0470163720
3. Gilbert Held, Understanding IPTV, CRC Press, 2006. ISBN: 0849374154
4. Wes Simpson, Video over IP, Focal Press, 2008.ISBN:978-0-240-81084-3.

17CS2046 IT INFRASTRUCTURE AND MANAGEMENT

Credits: 3:0:0

Course Objectives:

Enable the student to

- identify IT infrastructure components and architectural building blocks
- illustrate the infrastructure components and their specific performance, availability and security concepts.
- compare various other parts of the infrastructure, like datacenters, storage, and servers.

Course Outcomes:

The student will be able to

- recognize the information related to IT infrastructure management.
- classify the networking models and services towards infrastructure management.
- demonstrate the tasks and way of working of infrastructure architects.
- analyze the crucial architectural decisions and principles in the IT infrastructure.
- categorize the types of Datacenters available in the IT infrastructure.
- summarize the networking building blocks and storage building blocks

Unit I - Infrastructure Management Overview: IT infrastructure - Processes / Information building block - Applications building block - Application Platform building block - Infrastructure building blocks - Non-Functional attributes - Non-functional attributes - Non-functional Requirements.
Unit II - Availability Concepts: Calculating availability - MTBF and MTTR - Sources of unavailability - Availability patterns - Redundancy - Failover - Fall back - Business Continuity -Performance Concepts - Performance during infrastructure design -Performance of a running system - Performance patterns - Increasing performance on upper layers - High performance clusters.

Unit III - Security Concepts: Introduction - Risk management - Security Patterns - Identity and Access Management - Segregation of duties and least privilege - Layered security - Cryptography.
Unit IV - Datacentres: Datacentre building blocks - Datacenter categories - Location of the datacenter - Physical structure - Power supply - Cooling - Fire prevention - detection and suppression - Equipment racks - Datacentre cabling and patching - Datacentre energy efficiency -Servers.
Unit V - Networking, Networking building blocks - Network virtualization - Network availability - Network performance - Network security - Storage - Storage building blocks - Storage availability - Storage performance - Storage security - Virtualization - Operating Systems - End User

Text Book:

1. SjaakLaan, IT Infrastructure Architecture - Infrastructure Building Blocks and Concepts Second Edition, Lulu Press Inc., Second Edition 2013 ISBN 978-1-29125079-4

Reference Books:

1. Phalguni Gupta, Surya Prakash, Umarani Jeyaraman, IT Infrastructure and its Management Tata McGraw-Hill Education (India) Edition 2009, ISBN 978-0-07-068184-2
2. Foundations of IT Service Management: based on ITIL, by Jan Van Bon, Van Haren Publishing, 2nd edition 2005
3. Manoj Kumar Choubey, Saurabh Singhal, IT Infrastructure and Management Pearson Education, 2012, ISBN:9788131767214
4. Harris Kern, Stuart D. Galup, Guy Nemiro, IT Organization: Building A World-class Infrastructure Prentice Hall,ISBN-13: 978-0130222985
5. Rich Schiesser IT Systems Management: Designing, Implementing, and Managing World-Class Infrastructures, Prentice Hall PTR, 2001

17CS2047 MACHINE LEARNING PRINCIPLES AND APPLICATIONS

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the machine learning theory
- implement linear and non-linear learning models
- implement distance-based clustering techniques
- build tree and rule based models
- apply reinforcement learning techniques

Course Outcomes:
The students will be able to

- understand the learning models available in machine learning.
- explain the theory underlying machine learning.
- construct algorithms to learn linear and non-linear models.
- implement data clustering algorithms.
- design algorithms to learn tree and rule-based models.
- apply reinforcement learning techniques.

Unit I - Foundations of learning: Components of learning - learning models - geometric models - probabilistic models - logic models - grouping and grading - learning versus design - types of learning - supervised - unsupervised - reinforcement - theory of learning - feasibility of learning - error and noise - training versus testing - theory of generalization - generalization bound - approximation generalization tradeoff - bias and variance - learning curve.
Unit II - Linear models: Linear classification - univariate linear regression - multivariate linear regression - regularized regression - Logistic regression - perceptrons - multilayer neural networks - learning neural networks structures - support vector machines - soft margin SVM - going beyond linearity - generalization and overfitting - regularization - validation.
Unit III - Distance-based models: Nearest neighbor models - K-means - clustering around medoids - silhouttes - hierarchical clustering - k-d trees - locality sensitive hashing - non-parametric regression - ensemble learning - bagging and random forests - boosting - meta learning.

Unit IV - Tree and rule models: Decision trees - learning decision trees - ranking and probability estimation trees - regression trees - clustering trees - learning ordered rule lists - learning unordered rule lists - descriptive rule learning - association rule mining - first-order rule learning.
Unit V - Reinforcement learning: Passive reinforcement learning - direct utility estimation - adaptive dynamic programming - temporal - difference learning - active reinforcement learning - exploration - learning an actionutility function - Generalization in reinforcement learning - policy search - applications in game playing - applications in robot control.

Text Books:

1. Y. S. Abu-Mostafa, M. Magdon-Ismail, and H.-T. Lin, Learning from Data, AMLBook Publishers, 2012 ISBN: 978-1600490064.
2. P. Flach, Machine Learning: The art and science of algorithms that make sense of data, Cambridge University Press, 2012 ISBN: 978-1107422223.

Reference Books:

1. K. P. Murphy, Machine Learning: A probabilistic perspective, MIT Press, 2012, ISBN: 978-0262018029.
2. C. M. Bishop, Pattern Recognition and Machine Learning, Springer, 2007, ISBN: 978-0262018029.
3. D. Barber, Bayesian Reasoning and Machine Learning, Cambridge University Press, 2012 ISBN: 978-1107439955.
4. M. Mohri, A. Rostamizadeh, and A. Talwalkar, Foundations of Machine Learning, MIT Press, 2012, ISBN: 978-0262018258.
5. S. Russel and P. Norvig, Artificial Intelligence: A Modern Approach, Third Edition, Prentice Hall, 2009, ISBN: 978-9332543515.

17CS2048 MANAGEMENT INFORMATION SYSTEMS

Credits: 3:0:0

Course Objectivess:
Enable the student to

- explain the fundamental concepts of information systems in business.
- understand systems approach and know their uses in problem solving.
- realize how organizations are strategically using Information technology.
- know the challenges of analyzing and redesigning of information systems.

Course Outcomess:
The student will be able to

- describe the various concepts of information systems.
- infer the security and ethical issues in information systems.
- interpret the user-manager perspective on various information systems.
- differentiate between information theory and practice.
- summarize the nature of tactical and strategic information.
- choose network topologies for network managers and voice systems.

UNIT – I: Managers view: Frame work of information systems- Stage evolution of data processing- - System approach in problem solving and information systems for feedback-Making the transition to the learning - How IT support business activities- Inter organizational systems- Strategic Information systems - The risks - Do Information systems provide a competitive edge?
UNIT – II: The impact of IT: The reengineering of work- IT and business process redesign- IT and organizational structure- Computer systems- Secondary storage media and devices- Other acquisition issues
UNIT – III: System software: Microcomputer Operating systems- Application software, development software and software features- Selecting microcomputer software- File concepts- Communication system elements, modes and codes- Network topologies, types and remote access- Network concerns for managers and voice systems
UNIT – IV: Distributed processing and databases: Client/Server computing- Operational accounting and Financial information- Marketing information-Production Information-Human resource Information.- Financial information- Characteristics of decision making process-benefits - Expert system

UNIT – V: Information system planning: critical success factor- business system planning- organizing information systems plan- System analysis and design- development- evaluation- Management of information systems- data processing - management and control issues - Security and ethical issues of information systems

Text Book:

1. Robert Schultheis, Mary Sumner "Management Information Systems" McGraw - Hill Education India 22nd Reprint 2013 Edition 1999 ISBN 0-25625195-9.

Reference Books:

1. James A'O.Brien, Marakas "Management Information Systems" Tata McGraw-Hill Education, Edition, 2006 ISBN-13: 978-0073376813
2. Terry Lucey "Management Information Systems" Ninth Edition, Reprint 2005 © Thomson Learning ISBN-13:978--84480-126-84.
3. Ken J. Sousa, Effy Oz "Management Information Systems" Seventh Edition, Cengage Learning 2009 ISBN-13:978-1285186139 5.

17CS2049 MOBILE APPLICATION DEVELOPMENT IN ANDROID

Credits: 3:0:0
Pre-requisite: 17CS2017 Programming in Java.

Course Objectives:

Enable the student to

- understand the platform, tools, technology and process for developing mobile applications using Google Android.
- demonstrate the operation of the application, application lifecycle, configuration files, intents and activities.
- secure, tune, package, deploy and manage Android applications.

Course Outcomes:

The student will be able to

- identify the significant programming components, involving the sensors and hardware features of mobile device.
- discuss various mobile devices, including their capabilities and limitations.
- demonstrate mobile applications with appropriate, layouts and user interfaces.
- experiment applications with network connectivity, messaging and persistent storage.
- design and develop android applications for real time problems.
- explain how to deploy and publish mobile application.

Unit I - Introduction to Android, Activities and Intents: Features of Android - Architecture of Android - Native Android Applications - Types of Android Applications - Understanding the Android Software Stack - The Dalvik Virtual Machine - The Android Emulator - Dalvik Debug Monitor Service (DDMS) - The Android Debug Bridge (ADB) - Understanding Activities - Linking Activities Using intents - Calling Built-in Applications Using intents.

Unit II - Android User Interface, Layouts and Event Handling: Understanding the Components of a Screen - Adapting to Display Orientation - Managing Changes to Screen Orientation - Listening for UI notifications - Basic Views - Picker Views - List Views - Using image Views to Display Pictures - Using Menus with Views - Android-UI Layouts.

Unit III - Data Persistence and Content provider: Saving and Loading User Preferences - Persisting Data to Files - Creating and Using Databases –Firebase - Sharing Data in Android - Using a Content Provider - Creating User Defined Content Providers.

Unit IV - Peer-to-Peer Communication and Accessing Android Hardware: SMS Messaging - Sending e-Mail - Using the Camera - Using the Accelerometer - Android Telephony - Using Bluetooth - Managing Network and Wi-Fi Connections.

Unit V - Fragment, Location-Based Services and Publishing Android Applications: Fragment - Fragment Lifecycle - Tab Layout with Swipeable Views - Location Provider - Using Geocoder - Tracking Location - Preparing app for Publishing - Deploying APK Files.

Text Books:

1. Bill Stonehem, Google Android Firebase: Learning the Basics, First edition, Greenlights Publishing, 2016. ISBN 9781365223075.
2. Reto Meier, Professional Android 4 Application Development, Third edition, Wrox, 2012. ISBN 978-1118102275.
3. Wei-Meng Lee, Beginning Android Application Development, First edition, Wiley Publishing, 2011. ISBN: 978-1-118-01711-1.

Reference Books:

1. Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, Programming Android, Second Edition, O'Reilly Media , 2012. ISBN 978-1449316648.
2. Donn Felker, Android Application Development For Dummies, For Dummies, 2010. ISBN 978-0470770184.
3. Wallace Jackson, Android Apps for Absolute Beginners, Apress, 2011. ISBN 978-1430234463.

17CS2050 MOBILE APPLICATION DEVELOPMENT LAB

Credits: 0:0:2
Co-requisite: 17CS2049 Mobile Application Development in Android

Course Objectives:
Enable the student to

- learn the platform, tools and technology and process for developing mobile applications using Google Android.
- explore the Android application architecture, including the roles of the task stack, activities, and services
- get exposure about multimedia, database and connectivity in the Android operating system.

Course Outcomes:
The student will be able to

- list the necessary GUI components for a real time application.
- identify advanced UI widgets for scrolling, tabbing, and layout control
- illustrate menus via the Android action bar and handle menu selections.
- infer tools to create applications for a mobile platform.
- construct simple graphics with data persistence for mobile devices.
- evaluate different types of networking options for mobile devices.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2051 MOBILE COMPUTING

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the basic concepts and principles in mobile computing.
- apply major techniques involved and networks and systems issues.
- implement mobile computing systems and applications.

Course Outcomes:
The student will be able to

- identify the various applications and services of mobile computing.
- describe the working of underlying wireless and mobile communication networks and their technical features.
- illustrate the important issues of developing mobile computing systems and applications.
- compare the working principle concepts of GSM,GPRS,WAP,CDMA, 3G.
- formulate the security features of mobile computing.
- explain the multimedia applications for mobile computing.

Unit I - Introduction: Mobile Computing-Application and Services, Standards, Mobile computing Architecture, Design considerations for Mobile Computing, Mobile Computing through Telephony, Emerging Technologies Middleware and Gateways.
Unit II - Global system for Mobile Communication: Global system for mobile communication (GSM)-Short Message Service (SMS) - General Packet Radio Service (GPRS)
Unit III - Wireless Application Protocol (WAP): Introduction to WAP-MMS-GPRS Applications-CDMA Introduction - Spread Spectrum - CDMA vs GSM-Wireless data-Third Generation Networks-Applications on 3G.
Unit IV - Wireless LAN: Introduction-Intelligent Networks and Internetworking- Client programming, program for the palm OS.
Unit V - Voice over IP and Convergence: Multimedia-Networked multimedia application-Security issues-Security Protocols in mobile computing- New services.

Text Books:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, Mobile Computing Technology, Applications and Service Creation, 2nd edition, Tata McGraw Hill, 2010. ISBN 978-00-701-4457-5
2. Uwe Hansmann, Lothar Merk, Martin S Nicklous, Thomas Stober, Principles of Mobile Computing, 2nd edition, Wiley, 2006. ISBN 978-81-812-8073-2
3. Prasant Kumar Pattnaik, Rajib Mall, Fundamentals of Mobile Computing, PHI Learning, 2012. ISBN 978-81-203-4632-1

Reference Books:

1. Raj Kamal, Mobile Computing, 2nd edition, Oxford University Press, 2011, ISBN 978-01-980-6891-4 5.
2. Bfar, Mobile Computing principles, 1st edition, Cambridge University Press, 2008, 978-05-216-9623-4

17CS2052 MULTIMEDIA LAB

Credits: 0:0:2

Course Objectives:
Enable the student to:

- facilitate an understanding of how to create and design user-centered multimedia.
- provide hands-on experience in multimedia production.
- learn to include digitization of images, sounds, animation and video.

Course Outcomes:
The student will be able to

- state the basic knowledge on creating shapes, polygons and texturing.
- describe the background of designing and animation.
- apply motion picture sequence visually and technically representative of final production imagery.
- experiment 3D character models and apply texturing for the models.
- relate different types of lights available for animation.
- assess 3D characters and animate the behavioural characteristics of the models.

The faculty conducting the laboratory will prepare a list of 12 Experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2053 MULTIMEDIA SYSTEMS AND DESIGN

Credits: 3:0:0

Course Objectives:
Enable the student to

- recognize step-by-step approach to multimedia systems design.
- classify multimedia standards , compression and decompression technologies .
- illustrate detailed analysis of the various storage technologies.

Course Outcomes:
The student will be able to

- identify and explore the characteristics of multimedia systems

- discuss the different realizations of multimedia tools and their usage.
- apply various multimedia standards and compression technologies.
- analyse various storage technologies.
- explain about the design components of a real world multimedia solution
- judge and manage widely distributed data in a timely and effective manner

Unit I - Multimedia Systems Design: An Introduction - Multimedia Elements - Multimedia applications - Multimedia Systems Architecture - Evolving technologies for Multimedia - Defining objects for Multimedia systems - Multimedia Data interface standards - Need for Data compression - Multimedia Databases.
Unit II - Compression and Decompression: Types of compression - Binary Image compression Schemes - Color, Gray scale and Still - video Image compression - Video Image Compression - Audio compression - Fractal Compression.
Unit III - Multimedia Input Output Technologies: Key Technology Issues - Pen Input - Video and Image Display systems - Print output technologies - Image scanners - Digital Voice and Audio - Digital Camera - Video images and animation - Full-motion video.
Unit IV - Storage and Retrieval Technologies: Magnetic Media Technology - Optical Media - Hierarchical Storage management - Cache management for storage systems.
Unit V - Multimedia Application Design: Multimedia Application classes - Types of Multimedia systems - Virtual reality design - Components of Multimedia systems - Organizing Multimedia databases - Application workflow design issues - Distributed application design issues.

Text Books:

1. Prabhat K Andleighand KiranThakrar, Multimedia Systems and Design, PHI, 2009. ISBN: 81-203-2177-4.
2. Tay Vaughan, Multimedia Making it work, Fourth Edition, Tata McGraw-Hill. ISBN: 0-07-463953-6.

Reference Books:

1. Ze-Nain Li, Mark S.Drew, Fundamentals of Multimedia, PHI, ISBN:81-203-2817-5.
2. John F. Koegel Buford, Multimedia Systems, Third Edition, 2009, ISBN: 978-81-7758-827-9.
3. Gaurav Bhatnager, Shikha Mehta, SugataMitra, Introduction to Multimedia Systems, First Edition, 2004. ISBN: 0125004524.

17CS2054 NETWORK SECURITY LAB

Credits: 0:0:2
Co-requisite: 17CS2005 Cryptography and Network Security

Course Objectives:
Enable the student to
- implement various cryptographic algorithms.
- implement various principles of cryptosystems and network security

Course Outcomes:
The student will be able to
- describe the various symmetric and asymmetric key algorithms.
- identify the various types of ciphers.
- apply various key exchange algorithms.
- differentiate between various kinds of security attacks.
- create various network scenarios and test the security of the network.
- select the best communication protocols for better transactions.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester

17CS2055 PROGRAMMING IN J2EE

Credits: 3:0:0
Pre-requisite: 17CS2017 Programming in Java

Course Objectives:
Enable the student to

- examine the working principles of real time enterprise applications.
- discover the java technologies for multi-tier enterprise application development.
- develop the enterprise applications with cross platform capabilities.

Course Outcomes:
The student will be able to

- identify the java technologies to develop distributed enterprise applications.
- recognize the best practices to build java based web applications.
- demonstrate the multi-tier enterprise application development using major components of J2EE.
- model the enterprise application solution for real time problems of business organizations.
- design a service outsourcing model for an existing business applications with web services APIs.
- choose innovative approaches to build secure and efficient web application solutions for an enterprise organizations.

Unit I - Java EE 7 Overview: Exploring Enterprise Architecture Types - Exploring the Features of Java EE Platform - Web Applications and Java EE 7 - Introducing Web Applications - Exploring MVC Architecture - Working with JDBC 4.0
Unit II - Java EE Foundation: Working with Servlets 3.1– Handling Sessions in Servlets 3.1 - Java Server Pages 2.3 - Exploring JSP Expression Language 3.0 - Implementing Filters.
Unit III - Enterprise Java Beans: The New Enterprise Java Bean- Introduction to Session Bean– Java Persistence API- Message Driven Bean
Unit IV - Java EE Interconnectivity: TheJava Message Service - Working withJava Mail API– Securing Java EE applications - Java EE connector Architecture
Unit V - Web Services: Implementing SOA using Java Web Services - Working with Struts 2

Text Books:

1. Kogent Learning Solutions Inc, Java Server Programming Java EE 7 (J2EE 1.7), Black Book, Dreamtech Press, 2014, ISBN-10: 9351194175, ISBN-13: 978-9351194170
2. Rima Patel, Gerald Brose, Micah Silverman, Mastering Enterprise JavaBeans 3.0, Wiley-India Edition, 2008. ISBN-10: 0471785415, ISBN-13: 978-0471785415.

Reference Books:

1. Bryan Basham, Kathy Sierra, Bert Bates, Head First Servlets and JSP, O'Reilly Media, 2008, ISBN: 0596516681, ISBN-13: 9780596516680.
2. Phil Hanna, JSP 2.0: The Complete Reference, Osborne/McGraw-Hill, Second Edition, December 2002, ISBN-10: 0072224371, ISBN-13: 978-0072224375.
3. Esmond Pitt, Kathleen McNiff, Java.rmi: The Remote Method Invocation Guide, Addison-Wesley Professional, 2001. ISBN-10: 0201700433, ISBN-13: 978-0201700435
4. Kathy Sierra, Bert Bates, Head First EJB, O'Reilly Media, 2005. ISBN-10: 0596005717, ISBN-13:978-0596005719.

17CS2056 PROGRAMMING IN J2EE LAB

Credits: 0:0:2
Co–requisite: 17CS2055 Programming in J2EE

Course Objectives:
Enable the student to

- identify the process in developing real time projects.
- demonstrate the programming concepts of J2EE.
- design real time web applications.

Course Outcomes:
The student will be able to

- identify the client tier technologies to create interactive user interfaces.
- express the enterprise business data in an application server and manage using JDBC APIs.
- prepare the dynamic request and response using internet functionalities with Servlets and Java Server Pages
- model the business logic for the application services using Enterprise Java Bean technologies.
- develop object relational model for accessing enterprise application business data using Java Persistence APIs.
- relate the work flow and implementation of real time enterprise application.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD / Director and notify it at the beginning of each semester.

17CS2057 SERVICE ORIENTED ARCHITECTURE

Credits: 3:0:0

Course Objectives:
Enable the students to

- understand service-oriented architectural (SOA) model and the service-orientation design paradigm.
- categorize the possibilities of incorporating existing services for new applications and for automating business processes.
- assess the principles of linking business process and the process for performing security in SOA.

Course Outcomes:
The student will be able to

- recognize the SOA systems from traditional non-distributed systems.
- paraphrase the impact of SOA on business, software quality, efficiency, security, performance, and flexibility.
- demonstrate SOA based applications.
- analyze the issues in developing the web services.
- summarize real-world scenarios involving web services
- justify the need for a platform-independent service contract (WSDL) and messaging format SOAP

Unit I - Introduction to SOA: SOA with Web Service - Service Oriented Architecture Concepts– SOA Processes - Principles and Tools– Web Services Platform - Service Requesters and Service Providers– Approved Products– Technologies and Facilities–Service Governance, Processes, Guidelines, Principles, Methods, and Tools.
Unit II - SOA and Web Services: Service platform - Principles - Contract elements - Service level abstractions – WSDL and Service contracts - Architecture– Data Model - Service level interaction pattern - SOAP and HTTP– Request-Response and publish-subscribe paradigm - SOA and Web Service Integration.
Unit III - Multichannel Access and business process management: Architecture for Multi-Channel Access– Client/Presentation Tier - Channel Access Tier– Communication Infrastructure –Business Service Access Tier - Business Service Tier –Business Process Management Systems –Activity Monitoring - Combining BPM - SOA and Web Services - Orchestration –WS-BPEL.
Unit IV - Metadata Management and Security: Using Plain SOAP and WSDL - Metadata Specifications - XML –WSDL 2.0 - UDDI –Addressing –Policy– WS-Policy –Web Services Policy Language (WSPL) - WSDL 2.0 Features and Properties– Comparing the Policy Specifications –WS-Metadata Exchange - Web Services Security.
Unit V - Messaging and transaction processing: Reliable Messaging –Benefits of Reliable Messaging –Usage Scenarios for Reliable Messaging –Web Services Reliable Messaging Specifications –Comparing Web Services Reliable Messaging and Asynchronous Message Queuing - Notification - WS Eventing –WS Notification - Transaction processing.

Text Book:

1. Eric Newcomer and Greg Lomow, Understanding SOA with Web Services, Pearson Education India, New Delhi, 2005.ISBN: 10:0321180860.

Reference Books:

1. Michael P. Papazoglou, Web Services and SOA: Principles and Technology, Second Edition, Pearson Prentice Hall , 2011, ISBN 10: 0273732161 ,ISBN 13:9780273732167.
2. Michael Bell, Service-Oriented Modeling (SOA): Service Analysis, Design, and Architecture, Wiley, 2008. ISBN-10: 0470141115
3. Thomas, Erl, Service-Oriented Architecture: Concepts, Technology, and Design, Prentice Hall 2006, ISBN: 0-13-185858-0.
4. Barry Douglas K, Web Services and Service oriented Architectures- The Savvy Manager's Guide, Morgan Kaufmann Publishers, USA, 2013.ISBN: 0123983576,ISBN-13:978-0123983572.

17CS2058 SOFTWARE ENGINEERING LAB

Credit: 0:0:2
Co-requisite: 17CS2018 Software Engineering
Course Objectives:
Enable the student to

- understand the software engineering development lifecycle.
- develop a software by understanding systematic software development procedure.

Course Outcomes:
The student will be able to

- identify the individual phases of the project and its deliverables.
- infer the problem related to software crisis for a particular scenario.
- employa suitable software development model for the requirement.
- examine an application with innovative software design solutions.
- design and develop an application by following the software engineering principles.
- evaluate the phases of the projects pertinent to the quality, timeliness, and continuous improvement.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2059 STORAGE AREA NETWORK

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand storage networking properties, benefits, architectural concepts and technologies.
- apply different software components for storage area networks.
- develop and manage strategies for SAN deployment.

Course Outcomes:
The student will be able to

- define the storage fundamentals
- describe the components and uses of a Storage Area Networks (SAN)
- choose SAN applications for their network
- categorize storage networking issues
- set up customized SAN for their network
- appraise the SAN network

Unit I - Introduction to storage area networks: Understanding Storage Networking - Benefits - Data Center Evolution - Killer Apps for SANs.
Unit II - Storage Networks and Architecture: Storage networking architecture - A path from data to application - Network Storage systems - Storage in Storage Networking - Challenges - The cost of online storage –Making SAN storage to perform - Keeping SAN up and working - The Network in Storage Networking.
Unit III - Basic Software for Storage Networking: Software for SAN - Shared access data managers - Computer system IO performance - Volumes - Resilience - Performance and flexibility –File Systems and Application performance.

Unit IV - Advanced Software for SAN: Data Replication types - Using data replication - Cluster data models – Enterprise backup software for SAN - Backup management –Enterprise backup architecture - Policies - Minimizing the impact of backup - LAN free and server less backup.
Unit V - SAN implementation and Management strategies: Adopting Storage Networking–Steps to successful SAN deployment - Adoption alternatives - Managing SANs– Ideal management - Management and backup impact - Management standards - Challenges.

Text Book:

1. Paul Massiglia Richard Barker, Storage Area Network Essentials: A Complete Guide To Understanding And Implementing Sans, Wiley India Pvt Ltd, 2011, ISBN: 978-0-471-03445-2

Reference Books:

1. Robert spalding, Storage networks: the complete reference 1st Edition, Tata McGraw-Hill Education, Sixth reprint 2008, ISBN 13: 9780070532922
2. Emc Education Services, Information Storage and Management: Storing, Managing And Protecting Digital Information, Wiley India Pvt Ltd, 2011, ISBN 978-0-470-61833-2
3. Ulf Troppen, Rainer Erkens and Wolfgang Muller, Storage Networks Explained: Basics and Application of Fiber Channel SAN, NAS iSCSI and InfiniBand, Wiley India Pvt Ltd, 2012, ISBN: 978-0-470-86183-7

17CS2060 TCP/IP

Credits: 3:0:0
Pre-requisite: 17CS2004 Computer Networks

Course Objectives:
Enable the student to

- understand the technologies of TCP/IP protocols.
- analyze on hierarchical addressing, IPv4 and IPv6 addressing.
- design client- server communication using transport and application layer protocols.

Course Outcomes:
The student will be able to

- define the concepts of protocols and standards and their relationship to each other.
- discuss different network types and explain the addressing, super-netting, sub-netting, network translation and transition from IPv4 to IPv6 addresses.
- demonstrate the functionality of each layer in TCP/IP protocol suite.
- compare and contrast different unicast routing protocols.
- design a network to establish end to end communication by providing various application level services.
- choose appropriate protocols and addressing scheme for establishing communication in a network.

Unit I - Introduction and Underlying Technologies: The OSI model and TCP/IP protocol suite: Protocol layers - The OSI Model - TCP/IP Protocol Suite - Addressing. Underlying Technologies: Wired LANs - Wireless LANs - Point to Point WANs - Switched WANs - Connecting Devices.
Unit II - Network Layer: Introduction to network layer - IPv4 Addresses - Delivery and forwarding of IP Packets - Internet Protocol version 4 - Address Resolution Protocol - Internet control message protocol version 4 - Mobile IP - Unicast routing protocols.
Unit III - Transport Layer: Introduction to Transport layer: Transport layer services - Transport layer protocol. User Datagram Protocol: User datagram - UDP services - UDP applications. Transmission Control Protocol: TCP services - TCP features - Segment - State transition diagram - Windows in TCP - Flow control - Error control - Congestion control - TCP timers.
Unit IV - Application Layer: Dynamic Host Configuration Protocol - DHCP operation - Configuration -Domain Name Systems: Need for DNS - Namespace DNS in the Internet - Resolution - DNS messages - Types of records - Compression - Encapsulation - Registrars - DDNS - Security of DNS - World Wide Web and HTTP: Architecture - Web documents - HTTP.
Unit V - Next Generation: IPv6 Addressing - Address space allocation - Global unicast addresses - Auto configuration - Renumbering - IPv6 Protocol: Packet Format - Transition from IPv4 to IPv6. ICMPv6: Error Messages - Informational Messages - Neighbor-discovery Messages - Group-membership Messages.

Text Books:

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4th edition, McGraw Hill, 2013. ISBN 978-0-07-070652-1.

Reference Books:

1. Douglas E. Comer, Internetworking with TCP/IP: principles, protocols and architecture (Volume1), 6th Edition, PHI Learning, 2013, ISBN 978-8-12-034867-7.
2. Douglas E. Comer, David L. Stevens, Internetworking with TCP/IP, design, implementation and internals (Volume 2), 3rd Edition, PHI Learning, 2009, ISBN 978-8-12-032285-1.
3. Ed Tittel, Laura Chappell, TCP/IP, 1st Edition, Cengage Learning, 2008, ISBN 978-8-13-150596-0.
4. Dr.SidnieFeit, TCP/IP, architecture, protocols and implementation with IPv6 and IP Security, Tata McGraw-Hill, 2008, ISBN 978-0-07-026496-0.

17CS2061 TOTAL QUALITY MANAGEMENT

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the concepts and principles of total quality management.
- introduce philosophies and strategies to quality related issues.
- provide skills in diagnosing and analysing problems causing variation in manufacturing and service industry processes.
- create an awareness about the ISO and QS certification process and its need for the industries.

Course Outcomes:

The student will be able to

- define quality management philosophies and frameworks.
- identify the various tools and techniques of quality Management.
- employ analytical skills for investigating and analysing quality management issues in the industry and suggest implementable solutions to those.
- examine the Quality environment of the organization
- synthesize the TQM approach for manufacturing/service organization in length
- select and apply appropriate techniques in identifying customer needs, as well as the quality impact that will be used as inputs in TQM methodologies

Unit I - Introduction: Need for quality - Evolution of quality - Definition of quality - Dimensions of manufacturing and service quality - Basic concepts of TQM - Definition of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM.

Unit II - Tqm Principles: Leadership - Strategic quality planning, Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer complaints, Customer retention - Employee involvement - Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal - Continuous process improvement - PDSA cycle, 5s, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating.

Unit III - Tqm Tools & Techniques I: The seven traditional tools of quality - New management tools - six-sigma: Concepts, methodology, applications to manufacturing, service sector including IT - Bench marking– Reason to bench mark, Bench marking process - FMEA - Stages, Types.

Unit IV - Tqm Tools & Techniques II: Quality circles - Quality Function Deployment (QFD) - Taguchi quality loss function –TPM - Concepts, improvement needs - Cost of Quality - Performance measures.

Unit V - Quality Systems: Need for ISO 9000- ISO 9000-2000 Quality System - Elements, Documentation, Quality auditing- QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - Case studies of TQM implementation in manufacturing and service sectors including IT.

Text Book:

1. Dale H.Besterfiled, et al., Total Quality Management, Pearson Education, Third Edition, 2013.ISBN 978-81-317-3227-4.

Reference Books:

1. PoornimaM. Charantimath, Total Quality Management, Pearson Education, Second edition, 2013.ISBN978-81-317-3262-5.

2. Subburaj, Total quality management, McGraw-Hill Education (India) Pvt Limited, 2012.ISBN 1259001415, 9781259001413
3. James R. Evans and William M. Lindsay, The Management and Control of Quality, Sixth Edition, Thomson, 2010.ISBN 13:9780538452601.

17CS2062 VIRTUALIZATION

Credits: 3:0:0

Course Objectives:
Enable the student to

- learn about desktop, server, network and storage virtualization.
- be familiar about various applications and use cases of different virtualization techniques.

Course Outcomes:
The student will be able to

- state the benefits of virtualization.
- distinguish the types of virtualization.
- illustrate the management of virtual machines.
- differentiate the various virtualization products.
- design a virtualized information system.
- choose the right virtualization solutions.

Unit – I: Examining the Anatomy of a Virtual Machine: Introducing VM Types - Introducing Computer Components - Introducing Virtual Disk Types - Introducing Networking -Introducing Hardware - Introducing VM Products - Preparing a virtual machine host - Selecting a motherboard - considering your network - Supporting Generic SCSI - Considering storage options.
Unit – II: Installing VM applications on desktops: Installing VMware Workstation for Linux - Deploying and Managing VMs on the Desktop - Deploying VMs with VMware Workstation - Microsoft Virtual PC: Building a Linux VM - Managing VMs.
Unit – III: Installing and Deploying VMs on Enterprise Servers: Deploying and Managing Production VMs on Enterprise Servers.
Unit – IV: Backing Up and Recovering Virtual Machines: Using Virtual File Systems - Implementing Failover Clusters- Creating Load-Balanced Clusters.
Unit – V: Building Virtual Machine Clusters: Introducing Storage Networking - Virtualizing Storage - The Virtualized Information System.

Text book:

1. Matthew Portnoy, Virtualization Essentials, John Wiley and Sons, Inc.,2016, ISBN 1119267749.

Reference Books:

1. Chris Wolf, Erick M Halter, Virtualization: From the Desktop to the Enterprise, Apress, 2005, ISBN 1-59059-495-9.
2. Frederic P Miller, Agnes F Vandome, John Mc Brewster, Desktop Virtualization, Alphascript Publishing, 2009, ISBN 9786130272944.
3. Michael Fox, Demystifying the Virtual Desktop, Createspace, 2010, ISBN 9781456304690.
4. Michael Johnson, Desktop Virtualization: What you Need to Know For IT Operations Management, Tebbo, 2011, ISBN-13: 9781743042106.

17CS2063 WIRELESS AND VOIP SECURITY

Credits: 3:0:0

Course Objectives:
Enable the student to

- provide exposure to various threats in wireless networks and security solutions.
- understand the technologies and protocols that support security in wireless networks.
- understand VoIP and its security.

Course Outcomes:

The student will be able to

- define wireless security and its related attacks
- classify about the technologies and protocols that make up real secured wireless Network.
- demonstrate secure wireless LAN protocol, wireless authentication server and encryption protocol for wireless network
- analyze the security issues in wireless network
- formulate VOIP security best practices
- explain the implementation techniques for VOIP security

Unit I - Security principles and attacks: Security Principles–Importance of security - Good security thinking - Security terms -Wi-Fi Vulnerabilities - Changing the security model- Traditional security architecture- Danger of passive monitoring - Different Types of Attack– Classification of attacks - Attacks without keys - Attacks on the keys.

Unit II - IEEE 802.11, EAP and Radius protocols: Wireless Information Warfare- IEEE 802.11 Protocol Primer - Layers - Wireless LAN Organization - Basics of Operations in Infrastructure Mode - Protocol Details - Radio Bits- IEEE 802.11- WEP Working - Introduction - Authentication - Privacy - Mechanics of WEP - Is WEP secure-WPA-RSN and IEEE 802.11i - Introduction to IEEE 802.11i - Introduction to WPA - Differences Between RSN and WPA - Security Context - Keys - Security Layers - Relationship of the Standards-Access Control- IEEE 802.1X- EAP and RADIUS - Importance of Access Control -Authentication for Dial-in Users - IEEE 802.1X - EAP Principles – EAPOL-Messages used in IEEE 802.1X - Implementation considerations - RADIUS—Remote Access Dial-In User Service.

Unit III - Upper Layer Authentication: Introduction to Upper Layer Authentication - Use of Keys in Upper-Layer Authentication - A Detailed Look at Upper-Level Authentication Methods - Transport Layer Security (TLS) - Kerberos - Cisco Light EAP (LEAP) - Protected EAP Protocol (PEAP) - Authentication in the Cellular Phone World: EAP-SIM - WPA and RSN Key Hierarchy - Pairwise and Group Keys - Pairwise Key Hierarchy - Group Key Hierarchy –Key Hierarchy using AES-CCMP - Mixed Environments - Summary of Key Hierarchies - Details of Key Derivation for WPA - Nonce Selection -Computing the Temporal Keys - TKIP - TKIP Overview - Per-Packet Key Mixing - TKIP Implementation Details - Message Integrity - Michael Per-Packet Key Mixing.

Unit IV - Overview of VoIP: Sources of Vulnerability -Vulnerable Components -Myths Versus Reality - VoIP Threat Taxonomy - Threats against vulnerability - Threats against Confidentiality - Threats against Integrity - Threats against Social Context-Security Profiles in VoIP Protocols - H.323- Overview - Security Profiles.

Unit V - VoIP Network Elements: SIP - Overview - Security Profiles - MGCP - Overview - Security Profiles - Security Devices - Service Devices - Analysis and Simulation of Current Threats - Denial of Service - Malformed Messages - Sniffing / Eavesdropping - Spoofing / Identity Theft - VoIP Spam - Mitigation

Text Books:

1. Jon Edney, William A.Arbaugh, Real 802.11 Security Wi-Fi Protected Access and 802.11i, Pearson Education, 2004. ISBN: 81-297-0312-2.
2. Patrick Park, Voice over IP Security, 1st edition, Cisco Press, 2011, ISBN: 978-81-317-3488-9

Reference Books:

1. Thomas Porter, Michael Gough, How to Cheat at VoIP Security, 1st edition, Syngress Publishing, 2007, ISBN 978-1-59749-16
2. Randall K.Nichols, Panos C. Lekkas, Wireless Security: Models, Threats and Solutions,Tata McGraw Hill, 2006. ISBN: 0-07-061884-4.
3. PallapaVenkataram, SathishBabu, Wireless and Mobile Network Security, Tata McGraw-Hill, 2010, ISBN: 9780070700246

17CS2064 ESSENTIALS OF INFORMATION TECHNOLOGY

Credits: 3:0:0

Course Objectives:

Enable the student to

- study the basic concepts of python programming.
- understand the applications of object oriented programming.
- learn the concepts of database systems and its application.

Course Outcomes:
The student will be able to

- describe problems using pseudo-codes.
- extend the pseudo-code into coding by using python programming.
- employ object oriented concepts for solving real-world problems.
- illustrate the database concepts into problem solving techniques.
- develop SQL queries to create database.
- interpret the functional dependencies in database.

Unit I - Overview to Python: Problem Solving - pseudo code - Introduction to Python - Variables and Operators - Control Structures -Iteration - Data Structure - Standard Library and Regular Expression - Functions - File Operations.
Unit II - Object Oriented Fundamentals: Object Oriented Philosophy - Objects - Classes- Implementation of classes and objects in Python - Methods and Method Invocation - Inheritance - Aggregation and Association - Errors and Exception Handling.
Unit III - Fundamental of Database Systems: Introduction to Database Systems - Data Models - Database Languages - Relational Databases - Data Storage and Querying sale - Relational Model - Keys - Schema Diagrams - Design Process - Data Requirements - Logical Design.
Unit IV - ER Modelling and SQL: ER Modelling - Functional Dependencies - Introduction to SQL - Types of SQL - DDL,DML statements - Data Types of SQL - Select Statement with operators - IN, LIKE, IS, NULL, BETWEEN.
Unit V - Functions and Normalization: Single Row Functions - Multi Row Functions - Set Operations - Aggregate Functions - Normalization.

Text Book:

1. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, O'Reilly Media, Inc., 2015, ISBN: 1491939419, 9781491939413.
2. Abraham Silberschatz, Henry F.Korth, S.Sudharshan,"Database System Concepts", Sixth Edition, McGraw Hill, 2010, ISBN 978-0-07-352332-3.

Reference Books:

1. Charles Dierbach, "Introduction to Computer Science Using Python: A Computational Problem - Solving Focus", Wiley India Pvt. Ltd, June 2015, ISBN-10: 8126556013.
2. Ramez Elmasri, "Fundamentals of Database Systems", Seventh Edition, Pearson Education, 2015, ISBN 978-0133970777.

17CS2065 INFORMATION SYSTEM STRATEGY PLANNING AND MANAGEMENT

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the issues and approaches in managing the information systems function in corporate organizations.
- summarize the modern technologies on business decisions and the impact of IT on industries, markets, and organizations.
- compare various approaches to managing IT projects.

Course Outcomes:
The student will be able to

- identifying Opportunities to Use Technology for a Competitive Advantage and Increase the Value to the Business.
- classify the internetworking infrastructure and services.
- demonstrate the business networks and IT services.
- analyze the crucial architectural decisions and principles in the IT infrastructure.
- categorize the types of IT infrastructure and IT outsourcing.
- summarize the project management phases in Volkswagen and AtekPC projects.

Unit I - IT and strategy - IT and organization: The need - Information - Organization and Control - Case 1 The Five Competitive Forces that Shape Strategy - Case 2 Amazon.com: The Brink of Bankruptcy
Unit II - Extending the Enterprise: Understanding Business Networks - Case 3 Canyon Ranch - Case 4 Boeing's e-Enabled Advantage- Hybrid Governance Models, Building Collaborative Community
Unit III - Business Case for IT - Understanding Internetworking Infrastructure - Assuring Reliable and Secure IT Services - Case 1 CareGroup - Case 2 The Ipremier Company (A): Denial of Service Attack
Unit IV - Managing Diverse IT Infrastructures - Organizing and Leading the IT function - Managing IT Outsourcing –Case 3 Ford Motor Company: Supply Chain Strategy - Case 4 The Power of Virtual Integration: An Interview with Dell Computer's Michael Dell - Case 5 Strategic Outsourcing at Bharti Airtel Limited
Unit V - A Portfolio approach to Managing IT projects - Governance of the IT Function - Leadership of the IT Function Case 1 Information Technology and the Board of Directors - Case 2 Volkswagen of America: Managing IT Priorities - Case 3 The AtekPC Project Management Office

Text Book:

1. Lynda Applegate, Robert D Austin, FWarren McFarlan, "Corporate Information Strategy and Management: Text and Cases" McGraw-Hill Education (India) Edition 2007 ISBN-13:978-0-07-063584-5 ISBN-10: 0-07-063584-6

Reference Books:

1. Anita Cassidy, "A Practical Guide to Information Systems Strategic Planning", 2nd edition, Auerbach Publications 2006 Taylor and Francis Group ISBN 0-8493-5073-5
2. Steve Clark, "Information Systems Strategic Management, An Integrated Approach" Routledge 2007 Taylor and Francis Group, ISBN 978-0415-38186-4
3. Kevin Grant, Ray Hackney, David Edgar "Strategic Information Systems management" 2010 Cengage Learning EMEA, ISBN 978-1-4080-0793-8
4. John Ward and Joe Peppard "Strategic Planning for Information Systems" John Wiley and Sons Limited, 3rd edition, 2002 ISBN 0470-841-478

17CS2066 ENTERPRISE RESOURCE PLANNING LAB

Credits: 0:0:2
Co requisite: 17CS2035 Enterprise Resource Planning

Course Objectives:
Enable the student to

- configure and build OpenERP modules.
- implement the access control mechanisms and security policies of OpenERP.

Course Outcomes:
The student will be able to

- outline the components required in an ERP system.
- discuss the problems and give solutions for the business needs.
- manipulate and build OpenERP Modules.
- model and personalize OpenERP workflows.
- generate the templates for the business needs.
- summarize reports required for the business.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS2067 INTRODUCTION TO DATA ANALYTICS

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the basics of digital data and its types
- explain the various classification and clustering techniques
- adapt big data technologies for data analytics

Course Outcomes:
The Student will be able to

- list the benefits of data analytics in the real world.
- identify the business needs from the historic data available.
- choose the relevant algorithms to perform analytics on real world data.
- select the best visualization design which can communicate better about the data.
- formulate decisions based on the analysed data.
- predict solutions for real-world problems using data science.

Unit I - Getting Started With Data Science: Wrapping Your Head around Data Science - Exploring Data Engineering Pipelines and Infrastructure - Applying Data Science to Business and Industry.
Unit II - Using Data Science to Extract Meaning from Your Data: Introducing Probability and Statistics - Clustering and Classification - Clustering and Classification with Nearest Neighbor Algorithms - Mathematical Modeling in Data Science - Modeling Spatial Data with Statistics.
Unit III - Creating Data Visualizations that Clearly Communicate Meaning: Following the Principles of Data Visualization Design - Using D3.js for Data Visualization - Web-Based Applications for Visualization Design - Exploring Best Practices in Dashboard Design - Making Maps from Spatial Data.
Unit IV - Computing for Data Science: Using Python for Data Science - Using Open Source R for Data Science - Using SQL in Data Science - Software Applications for Data Science.
Unit V - Applying Domain Expertise to Solve Real-World Problems Using Data Science: Using Data Science in Journalism - Delving into Environmental Data Science - Data Science for Driving Growth in E-Commerce - Using Data Science to Describe and Predict Criminal Activity - Ten Phenomenal Resources for Open Data - Free Data Science Tools and Applications.

Text Book:

1. Lillian Pierson, Data Science For Dummies, Wiley, 2015, ISBN: 978-1-118-84152-5

References Books:

1. Hastie, Trevor, Robert Tibshirani and Jerome Friedman, The elements of statistical learning - Data mining, Inference and Prediction, Second Edition, springer, 2009, ISBN: 978-0-387-84857-0
2. Jiawei Han and Micheline Kamber, Data Mining Concepts and Techniques, Chris Ullman, Morgan Kaufmann Publishers, Third Edition, 2011, ISBN: 0123814790, ISBN -13 9780123814791
3. Seema Acharya and Subhashini Chellappan, Big data and analytics, John Wiley and Sons, 2015

17CS2068 FUNDAMENTALS OF PYTHON PROGRAMMING

Credits: 3:0:0

Objective:
Enable the student to

- understand the most important libraries of Python, and its recommended programming styles and idioms.
- learn core Python scripting elements such as variables and flow control structures.
- develop applications using Python.

Outcome:
The student will be able to

- outline the structure and components of a Python program.
- explain loops and decision statements in Python.
- illustrate class inheritance in Python for reusability
- experiment read and write files in Python.
- design, code, and test small Python programs that meet requirements expressed in English.
- choose lists, tuples, and dictionaries in Python programs.
- assess object-oriented programs with Python classes.

Unit I - Introduction to Python, Data Types, Expressions: Introduction to Python Programming - Running Code in the Interactive Shell, Input, Processing and Output, Editing, Saving and Running a Script - Data Types, String Literals, Escape Sequences, String Concatenation, Variables and the Assignment Statement - Numeric Data Types

and Character Sets - Integers and Long Integers, Floating-Point Numbers and Character Sets - Expressions - Arithmetic Expressions and Mixed-Mode Arithmetic and Type Conversions.

Unit II - Functions, Modules and Control Statements: Functions and Modules - Calling Functions, The math Module, The Main Module, Program Format and Structure and Running a Script from a Terminal Command Prompt - Iteration - for loop - Selection - Boolean Type, Comparisons, and Boolean Expressions, if-else Statements, One-Way Selection Statements, Multi-way if Statements, Logical Operators and Compound Boolean Expressions, Short-Circuit Evaluation and Testing Selection Statements - Conditional Iteration - while loop.

Unit III - Strings and Text Files: Strings - Accessing Characters and Substrings in Strings, Data Encryption, Strings and Number Systems and String Methods - Text Files - Text Files and Their Format, Writing Text to a File, Writing Numbers to a File, Reading Text from a File, Reading Numbers from a File and Accessing and Manipulating Files and Directories on Disk.

Unit IV - Lists and Dictionaries: Lists - List Literals and Basic Operators, Replacing an Element in a List, List Methods for Inserting and Removing Elements, Searching and Sorting a List, Mutator Methods and the Value None, Aliasing and Side Effects, Equality and Tuples - Defining Simple Functions - Syntax , Parameters and Arguments, return Statement, Boolean Functions and main function, DICTIONARIES - Dictionary Literals, Adding Keys and Replacing Values, Accessing Values, Removing Keys and Traversing a Dictionary.

Unit V - Design with Functions and Design with Classes: Design with Functions and Design with Classes - Functions as Abstraction Mechanisms, Problem Solving with Top-Down Design, Design with Recursive Functions and Managing a Program's Namespace - DESIGN WITH CLASSES - Objects and Classes, Data Modeling and Structuring Classes with Inheritance and Polymorphism.

Text Book:

1. Paul Barry, Head First Python 2e, O'Reilly, 2nd Revised edition, 2016, ISBN-13: 978-1491919538.
2. Kenneth A. Lambert, Martin Osborne, Fundamentals of Python: From First Programs Through Data Structures, Course Technology, Cengage Learning, 2010, ISBN-13: 978-1-4239-0218-8.

Reference Books:

1. Zed A. Shaw, Learn Python The Hard Way, Addison-Wesley, Third Edition, 2014, ISBN-13: 978-0-321-88491-6.
2. Dave Kuhlman, A Python Book: Beginning Python, Advanced Python, and Python Exercises, 2013, ISBN: 9780984221233.
3. Kent D Lee, Python Programming Fundamentals, Springer-Verlag London Limited, 2011, ISBN 978-1-84996-536-1.

17CS2069 PROGRAMMING IN PYTHON

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the fundamental principles of Object-Oriented Programming, as well as in-depth data and information processing techniques.
- solve problems, explore real-world software development challenges, and create practical and contemporary applications.

Course Outcomes:

The student will be able to

- infer object oriented programming constructs, control statements and Python library.
- identify Python object types.
- use Python modules for reusability
- identify the necessary attributes and methods of an object andhierarchical classification of classes.
- experiment exception handling in Python applications for error handling.
- develop application using multi-threading, IO concepts / GUI to solve real-time problems.
- design and program Python applications.
- create prototype for the real time application.

Unit I - Introduction to Python, Expressions and Arithmetic, Conditional Execution and Iteration: Development Tools - Learning Programming with Python – IntegerValues – Variables and Assignment, Identifiers,

Floating-pointTypes, ControlCodeswithinStrings, UserInput, evalFunction and Controllingtheprint - Expressions – OperatorPrecedenceandAssociativity,Comments and Errors – ArithmeticOperators- BooleanExpressions, ifStatement, if/elseStatement, CompoundBooleanExpressions, NestedConditionals, Multi-way Decision Statements, ConditionalExpressions and ErrorsinConditionalStatements – Iteration – whileStatement, DefiniteLoopsvs.IndefiniteLoops, forStatement, NestedLoops, AbnormalLoopTermination and InfiniteLoops.

Unit II - Functions,Lists, Objects, Custom Types and Exception Handling: Using Functions - timeFunctions, Random Numbers and Importing Issues, Standard Mathematical Functions, Writing Functions, Function Basics, Main Function, Parameter Passing and CustomFunctionsvs.StandardFunctions, Global Variables and Default Parameters, Recursion, Making Functions Reusable, Documenting Functions and Modules and Functions as Data – Lists - Using Lists, List Assignment and Equivalence, List Bounds, Slicing, Lists and Functions, Prime Generation with a List - List Processing – Sorting, Flexible Sorting and Search - Objects - Using Objects, String Objects and List Objects - Custom Types – GeometricPoints, Methods and Class Inheritance – Exception Handling - try/except mechanism and Cleaning up with finally.

Unit III - Simple Graphics and Image Processing: Simple Graphics - Overview of Turtle Graphics, Turtle Operations, Object Instantiation and the turtlegraphics Module, Drawing Two-Dimensional Shapes, Taking a Random Walk, Colors and the RGB System and Using the str Function with Objects - Image Processing - Analog and Digital Information, Sampling and Digitizing Images, Image File Formats, Image-Manipulation Operations, The Properties of Images, The images Module, A Loop Pattern for Traversing a Grid, A Word on Tuples, Converting an Image to Black and White/Grayscale, Copying and Blurring an Image, Edge Detection and Reducing the Image Size.

Unit IV - Graphical User Interfaces:GUI-Based Programs - Terminal-Based Version, GUI-Based Version and Event-Driven Programming, Windows and Labels, Displaying Images, Command Buttons and Responding to Events and Viewing the Images of Playing Cards, Entry Fields for the Input and Output of Text, Using Pop-up Dialog Boxes and Other Useful GUI Resources.

Unit V - Multithreading, Networks, And Client/Server Programming|: Threads and Processes - Threads, Sleeping Threads, Producer, Consumer, and Synchronization - Networks, Clients, and Servers - IP Addresses, Ports, Servers, and Clients , Sockets and a Day/Time Client Script, A Day/Time Server Script, A Two-Way Chat Script, Handling Multiple Clients Concurrently and Setting Up Conversations for Others.

Text Book:

1. Michal Jaworski, Tarek Ziade, Expert Python Programming, Packt Publishing, Second Revised edition, 2016, ISBN-13: 978-1785886850.
2. Sam Washington, Dr. M. O. Faruque Sarker, Learning Python Network Programming, Packt Publishing Limited, 2015, ISBN-13: 978-1784396008.
3. Kenneth A. Lambert, Martin Osborne, Fundamentals of Python: From First Programs Through Data Structures, Course Technology, Cengage Learning, 2010, ISBN-13: 978-1-4239-0218-8.

Reference Books:

1. Rick van Hattem, Mastering Python, Packt Publishing, Second Edition, 2016, ISBN 139781786463746.
2. Effective Python: 59 Specific Ways to Write Better Python, Addison-Wesley Professional, First edition, 2015, ISBN-13: 978-0134034287.
3. Zed A. Shaw, Learn Python The Hard Way, Addison-Wesley, Third Edition, 2014, ISBN-13: 978-0-321-88491-6.
4. Dave Kuhlman, A Python Book: Beginning Python, Advanced Python, and Python Exercises, 2013, ISBN: 9780984221233.
5. Paul Barry, Head First Python 2e, O'Reilly, 2nd Revised edition, 2016, ISBN-13: 978-1491919538.
6. Kent D Lee, Python Programming Fundamentals, Springer-Verlag London Limited, 2011, ISBN 978-1-84996-536-1.

17CS3001 ACCESS AND IDENTITY MANAGEMENT

Credit: 3:0:0

Course Objectives:

Enable the student to

- teach access manager administration and identity provider administration.
- demonstrate how to troubleshoot identity server and access gateway.
- experiment single sign on, identity sharing, federation, SSL VPN, backup and fault tolerance.

Course Outcomes:
The student will be able to

- describe basic operations and working of access manager and identity manager.
- explain access manager, identity manager configuration.
- use logs, perform troubleshooting and reporting.
- examine certificates, packages, drivers, user applications and enterprise applications.
- create packages, filters, policies and workflows.
- assess SSO, Federation Identity Injection and form fill.

Unit I - Getting familiar with Access Manager: Introduction to Access manager - Installation of Access Manager - Administration Console administration and configuration - Logging for Troubleshooting and Compliance.
Unit II - Web server acceleration and proxy options: Web Server Acceleration - HTML Rewriting - Certificate Management - Authentication and Customizing the User Interface - Role-Based Access Control - Role-Based Access Control - Identity Injection and Form Fill.
Unit III - Sharing Identities: Sharing Identities with Federation - Securing Enterprise Applications - Component Clustering.
Unit IV - Getting familiar with Identity Manager: Describe Novell Identity Manager 4.0 - Administer Identity Manager - Understand Designer for Identity Manager - Manage Content with Packages - Identity Manager Drivers.
Unit V - Identity Management: Manage Policies and Filters - Troubleshoot With DSTrace - Manage User Application - Implement Identity Manager Password Synchronization - Reporting Module.

Reference Books:

1. NetIQ Access manager -lecture, Novell Inc., 2013, USA
2. NetIQ Identity Manager - lecture Novell Inc, 2013, USA
3. MessaoudBenantar, Access Control Systems: Security, Identity Management and Trust Models, Springer, 2006, ISBN-13: 978-0387004457
4. Raj Sharman, Sanjukta das Smith, Manish Gupta, Digital Identity and Access Management: Technologies and Frameworks, Business Science Reference, 2012, ISBN-13: 978-1613504987.
5. Elisa Bertino, Kenji Takahashi, Identity Management: Concepts, Technologies, and Systems, Artech House, 2011, ISBN: 978-1608070409.

17CS3002 ADVANCED COMPUTER ARCHITECTURE

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the advanced concepts of computer architecture.
- analyze modern design structures of pipelined and multiprocessors systems.
- appraise recent computer architectures and I/O devices.

Course Outcomes:
The student will be able to

- describe the contemporary computer architecture issues and techniques.
- discuss performance of different instruction set architectures.
- apply concepts of high-performance computer architecture and pipelining logic.
- distinguish various multiprocessing configurations.
- design the overall organization of parallel computer models and advanced processors.
- develop applications for high performance computing systems.

Unit I - Fundamentals of Computer Design, Addressing, Instruction set: Introduction - The changing face of computing and the task of the computer designer -Technology Trends - Cost- Price and their trends - Measuring and Reporting performance -Quantitative Principles of computer design -Performance and Price- Instruction set Principles and Examples: Introduction -Classifying Instruction set Architectures- Memory Addressing -Addressing Modes for signal processing -Type and size of operands -Operands for media and signal processing -operations in the instruction set - Instruction for control flow - Encoding an instruction set .

Unit II - Pipelining: Introduction - The Major Hurdle of pipelining - pipeline Hazards - Implementation - Extending the MIPS pipeline to handle multi cycle operations Instruction -Level parallelism: concepts and challenges - overcoming data Hazards with Dynamic scheduling - Dynamic scheduling: Examples and the Algorithm - Reducing Branch costs with Dynamic Hardware Prediction - High Performance instruction delivery -Taking advantage of More ILP with Multiple Issue - Hardware - Based speculation - Studies of the Limitations of ILP - Limitations of ILP for Realizable processors.

Unit III - Exploiting Instruction: Level Parallelism with Software Approaches- Basic compiler Techniques for Exposing ILP - Static Branch Prediction - Static Multiple issue: The VLIW approach - advanced compiler support for Exposing and Exploiting ILP -Hardware support for Exposing more parallelism at compile Time - crosscutting issues: Hardware versus software speculation mechanisms.

Unit IV - Multiprocessors and Thread: Level Parallelism: Introduction - Characteristics of Application domains - symmetric shared - memory architectures - performance of symmetric shared - memory multiprocessors Distributed shared - memory architectures - performance of distributed shared - memory multiprocessors - synchronization - models of memory consistency: Introduction .

Unit V - Multithreading: Exploiting Thread - Level parallelism within a processor- Memory Hierarchy Design: Introduction - Review of the ABCs of the caches- Cache Performance - Reducing Cache Miss Penalty - Reducing Miss Rate - Reducing Cache Miss Penalty or Miss Rate via Parallelism - Reducing Hit Time - Main Memory and Organizations for Improving Performance - Memory Technology -Virtual Memory - Protection and Examples of Virtual Memory

Reference Books:

1. John L. Hennessy and David Patterson, Computer Architecture, A Quantitative Approach, Fourth Edition, Elsevier, 2012. ISBN-*13:012383872X*
2. Kai Hwang, Advanced Computer Architecture, Parallelism, Scalability, Programmability, McGraw-Hill, ISBN: 0070316228, Eighteenth Reprint-2008
3. Barry Wilkinson and Michael Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2nd Edition, Prentice Hall, 2005. ISBN: 0-13-140563-2.
4. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGraw -Hill, New York, 2012, ISBN: 9781259029141,
5. H.S.Stone, High Performance Computer Architecture, Addison Wesley, Reading Mass, 2009, Reprint Edition ISBN: 9780201168020.
6. W. Stallings, Computer Organization and Architecture, Ninth Edition, 2012, ISBN 9780132936330.

17CS3003 ADVANCED DATABASE LAB

Credit: 0:0:2
Co-requisite: 17CS3004 Advanced Database Systems

Course Objectives:
Enable the student to

- familiarize with PL/SQL for storing, maintaining and querying large databases effectively.
- acquire knowledge on advanced techniques in handling concurrent transactions.

Course Outcomes:
The student will be able to

- describe and use various advanced query concepts such as subquery, correlated subquery, procedures, functions and nosql queries.
- select the appropriate locking techniques and apply it on the database objects.
- practice backup and recovery.
- analyze the concurrent transactions and deadlocks.
- design and implement database application.
- assess various indexing techniques.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS3004 ADVANCED DATABASE SYSTEMS

Credits: 3:0:0

Course Objectives:

Enable the student to

- gain extensive knowledge on database system architecture, system implementation techniques query processing and optimization.
- acquire in depth knowledge on transaction processing concepts, concurrency control techniques, database recovery techniques, database security and authorization.
- understand the concepts of application-oriented and system-oriented approach towards database design.

Course Outcomes:

The student will be able to

- identify alternative designs for implementation of database systems, including data models, file structures, index schemes, and query evaluation.
- recognize appropriate techniques for transaction processing, concurrency control, backup and recovery that maintain data integrity in database systems.
- apply locks and isolation levels to the concurrent transactions.
- analyze the operation of parallel and distributed database.
- design and implement significant database objects such as file structures and index schemes.
- explain the concepts of information retrieval and spatial data management.

Unit I - Overview Of Query Evaluation: The System catalog- introduction to Operator Evaluation- Algorithms for Relational Operators-Introduction to Query Optimization-Alternative Plans: example- A Typical Relational Query Optimizer: Translating SQL Queries into Algebra- Estimating the cost of a plan- Relational Algebra Equivalences-Enumeration of Alternative plans- Nested Subqueries- The System R Optimizer

Unit II - Overview of Transaction Management: The ACID Properties-Transactions and Schedules-Concurrent Execution of Transaction-Lock-Based Concurrency Control-Performance of Locking-Transaction Support in SQL-Introduction to Crash Recovery - Concurrency Control - 2PL, Serializability and Recoverability-Introduction to Lock Management-Lock Conversion-Dealing with Deadlock-Specialized Locking Techniques- Concurrency Control without Locking. Crash Recovery: Introduction To ARIES -The Log: Other Recovery-Related Structures-The Write-ahead Log Protocol -Check Pointing- Recovering from a System Crash -Media Recovery.

Unit III - Physical Database Design and Tuning: Introduction to Physical Database Design - Guidelines for Index Selection-Clustering and Indexing -Tools to Assist Index Selection - Overview of Database Tuning -Choices in Tuning the Conceptual Schema-Choices in Tuning Queries and Views -Impact of Concurrency- Case Study: The Internet Shop.

Unit IV - Parallel And Distributed Databases: Architecture for Parallel Databases-Parallel Query Evaluation-Parallelizing Individual Operations-Parallel Query Optimization-Types of Distributed Databases -Distributed DBMS Architecture-Storing Data in Distributed DBMS- Distributed Catalog management-Distributed Query Processing-Updating Distributed Data Distributed Transaction-Distributed Concurrency Control-Distributed Recovery.

Unit V - Spatial Data Management, Security and Authorization: Types of Spatial Data and Queries-Application involving Spatial Data-Introduction to Spatial Indexes-Indexing Based on Space Filling Curves Grid files -R-Trees - Issues in High Dimensional Indexing. Introduction to Database Security-Access Control- Discretionary and Mandatory Access Control-Security for Internet Application - Additional Issues Related to Security.

Reference Books:

1. Raghu R. and Johannes G., Database Management Systems, Third Edition, Tata McGraw Hill, 2014. ISBN 978-9339213114
2. Elmasri and Navathae, Fundamentals of Database Systems, Sixth Edition, Pearson Education /Addison Wesley, 2010. ISBN 0136086209
3. Abraham S., Henry F.Korth and Sudarshan, Database System Concepts, Fifth Edition, McGraw-Hill Publication, 2006. ISBN: 007-124476-X
4. Thomas C. and Carolyn B., Database Systems - A Practical Approach to Design, implementation, and Management, Third Edition, Pearson Education, 2007. ISBN 81-7808-861
5. Li Yan, Zongmin Ma, Advanced Database Query Systems: Techniques, Applications and Technologies, Idea Group Inc (IGI), 2011,ISBN-160960475X

17CS3005 ADVANCED OPERATING SYSTEMS

Credits: 3:0:0

Course Objectives:
Enable student to

- provide comprehensive and up-to-date coverage of the major developments in distributed Operating System, Multi-processor Operating System and Database Operating System.
- impart knowledge on important theoretical foundations including Process Synchronization, Concurrency, Event ordering, Mutual Exclusion, Deadlock, Agreement Protocol,
- identify the key issues Security, Recovery and fault tolerance mechanisms.

Course Outcomes:
The Students will be able to

- recall the theoretical foundation of distributed operating systems.
- classify various synchronization problems.
- analyse the solution for mutual exclusion.
- examine a fault tolerant system.
- discover various security essentials.
- assess the theoretical aspects of concurrency control.

Unit I - Synchronization Mechanisms: Distributed Operating Systems -Architectures of Distributed Systems, Theoretical Foundations-Distributed Mutual Exclusion-Distributed Deadlock detection - Agreement Protocols.
Unit II - Distributed Resource Management: Distributed File Systems - Mechanisms for Building distributed File system- Distributed Shared memory- Distributed Scheduling.
Unit III - Failure Recovery: Fault Tolerance introduction -Recovery -Classification of Failure -Backward and Forward error Recovery - Recovery in Concurrent Systems - Synchronous and Asynchronous Checkpoint and Recovery - Fault Tolerance.
Unit IV - Protection and Security: Resource Security and protection -Introduction to Resource Security and Protection - Preliminaries -The Access Matrix Model
-Implementation of Access Matrix - The Lock-Key method - Multiprocessor Operating systems - Multiprocessor System Architectures.
Unit V - Database Operating Systems: Introduction to Database Operating systems - Concurrency Control, Theoretical Aspects - Concurrency Control Algorithms.

Reference Books:

1. Ajay D. Kshemkalyani, MukeshSinghal, Distributed Computing: Principles, Algorithms, and Systems, 2011, Cambridge University Press; Reissue edition. ISBN-10: 0521189845.
2. Mary Gorman, Todd Stubbs, Introduction to Operating Systems: Advanced Course, CourseTechnology, 2003. ISBN: 9780619055301.
3. MukeshSinghal, NiranjanG.Shivaratri, Advanced Concepts in Operating Systems Distributed, Database, and Multiprocessor Operating Systems, Tata McGraw-Hill, 1994. ISBN: 0-07-047268-8.
4. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, fifth Edition 2011, ISBN-10: 0132143011.
5. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, JohnWiley and Sons, Seventh Edition, 2006. ISBN: 9812-53-176-9.
6. Yair Wiseman, Song Jiang, Advanced Operating Systems and Kernel Applications: Techniques and Technologies, IGI Global Snippet, 2010, ISBN-1605668516.

17CS3006 ADVANCED OPERATING SYSTEMS LAB

Credits: 0:0:2
Co-requisite: 17CS3005 Advanced Operating Systems

Course Objectives:
Enable the student to

- provide comprehensive and up-to-date coverage of the major developments in distributed operating.
- learn the functionality of Multi-processor operating system and database operating system.
- cover important distributed operating system concepts like Process Synchronization, Concurrency.

- event ordering, mutual exclusion, deadlock, agreement protocol, security, recovery and fault tolerance.

Course Outcomes:

The student will be able to

- reproduce and test various operating system algorithms.
- select the best algorithms to implement distributed environment for an operating system.
- identify and analyse the algorithms to find the shortest path.
- experiment various scheduling algorithms.
- write shell programs and use various unix system calls and commands.
- justify the reason for deadlock and recover it using operating system algorithms.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS3007 ANALYSIS, ARCHITECTURE AND DESIGN OF NETWORKS

Credits: 3:0:0

Course Objectives:

Enable the student to

- identify and apply the services and performance levels that a network must satisfy.
- understand the parameters of network analysis such as network service characteristics, performance Characteristics, network requirements analysis, and network flow analysis.

Course Outcomes:

The student will be able to

- describe the basic concept of analysis, architecture and design of network.
- identifythe requirement and apply them in architecture and design decisions.
- illustrate vendors, vendor products, service providers in a network design phase.
- analyze how and where addressing and routing, security, network management and performance are implemented in the network and how they interact with each other.
- formulate network management and performance architecture..
- evaluate the network design plan and mechanism.

Unit I - Overview of Analysis, Architecture and Design Processes - A Systems - Methodology -System Description - Service Description - Service Characteristics - Performance Characteristics - Network Supportability.

Unit II - Requirements Analysis Concepts- User requirement - Application requirement - Device requirement - Network requirement - other requirements - Requirement Specifications and Map -Requirements Analysis Process.

Unit III - Flow Analysis - Identifying and Developing Flows - Data Sources and Sinks - Flow Models, Prioritization and specification - Network Architecture-Addressing.

Unit IV - Network Management Architecture - defining Network Management - Network management mechanisms - Architectural considerations - Performance Architecture**.**

Unit V - Security and Privacy Architecture - Developing security and privacy plan - Security and privacy administration and mechanisms - Architectural considerations - Network Design.

Reference Books:

1. James D, McCabe, Network Analysis, Architecture and Design, Third Edition, Elsevier, 2008. ISBN: 978-81-312-1259-2.
2. Darren L, Spohn, Tina L. Brown, Scott Garu, Data Network Design, Third Edition, Tata McGraw Hill, 2008 ISBN 978-0-07-0530416
3. James D, McCabe, Network Analysis, Architecture and Design, Second Edition, Elsevier, 2007. ISBN: 1-55860-887-7.
4. Tony Kenyon, High-performance Data Network Design: Design Techniques and Tools, Digital Press, 2002 ISBN 1-55558-207-9
5. Andrew S. Tanenbaum, David J. Wetherall Computer Networks, Fourth Edition, Prentice Hall, Upper Saddle River, New Jersey, 2011. ISBN: 0132553179

17CS3008 APPLIED SECURITY LAB

Credit 0:0:2
Co-requisite: 17CS3001 Access and Identity Management

Course Objectives:
Enable the student to

- experiment access manager proxy administration and identity provider administration.
- experience on how to troubleshoot identity server and access gateway.
- perform single sign on, identity sharing, federation, SSL VPN, backup and fault tolerance.

Course Outcomes:
The student will be able to

- define and configure networks and security sources.
- review logs, troubleshoot access manager and identity manager.
- apply single sign on, user application authentication and identity injection in access manager.
- test the configuration and perform the installation of access manager and identity manager.
- create web server acceleration, SSL, proxy and multihoming.
- evaluate the federation of identity using SAMIL.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS3009 CLOUD COMPUTING LAB

Credit: 0:0:2
Co-requisites: 17CS3010 Cloud Computing Services

Course Objectives:
Enable the student to

- describe and configure cloud environment.
- experiment with workload instances.
- design a private cloud environment.

Course Outcomes:
The student will be able to

- define cloud environment setup using SUSE openstack cloud.
- describe projects, users, domains ,groups and manage identity.
- demonstrate and work with cloud images.
- illustrate software defined networks.
- create workload instances and manage block and object storage.
- evaluate cloud orchestration and measure cloud infrastructure utilization.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS3010 CLOUD COMPUTING SERVICES

Credit: 3:0:0
Course Objectives:
Enable the student to

- understand the basic concepts of cloud computing
- setup their own cloud environment
- summarize on the various types of open source technologies for cloud computing

Course Outcomes:
The student will be able to

- outline the basic concepts of cloud computing.
- explain the SUSE open stack environment.
- apply and demonstrate Open Stack services for various applications.
- analyze on software defined networks.
- set up own cloud with appropriate networking and storage techniques.

- estimate the resources utilized for various applications.

Unit I - Introduction to Cloud Computing and Crowbar: Cloud Computing Models- Open source cloud computing - Open Stack Cloud - Crowbar - Open stack Core Components - Nova - Swift - Glance - Dashboard - Keystone - Understand crowbar - Crowbar Machine deployment - Register and Allocate Nodes with Crowbar - Admin Server - Cloud Infrastructure Networks.
Unit II - SUSE Cloud: SUSE Open Stack Cloud - Clusters for Open Stack Services - Accessing Cloud Nodes via SSH - Open Stack Bar Clamps in Clustered Environment - Admin Node - Batch Deployment - OpenStack Components - OpenStack Architecture.
Unit III - OpenStack Services: Open Stack Identity Service - Keystone Features and Functionality - Open Stack Tenants and Users - Keystone Configuration Commands for Tenants and Users - Quotas - Keystone - Commands for Domains and Groups - Cloud Images - Glance Features and Functionality - Image Types and SUSE Studio/Kiwi - Glance Configuration Commands - Glance Troubleshooting.
Unit IV - Networking: Software Defined Networks in OpenStack - OpenStack Networking - Security Groups Neutron Configuration Commands - Neutron Troubleshooting - Work with Cloud Workload Instances - Nova Features and Functionality - Instances and Flavors - Nova Configuration Commands - Basic Nova Troubleshooting.
Unit V - Storage: Storage in OpenStack - Cinder Features and Functionality - Cinder volume types - Cinder Troubleshooting - Object Storage in OpenStack - Swift Features and Functionality - Swift Troubleshooting - Ceph Features and Functionality - Lifecycle of Cloud Applications - Meter Cloud Resource Utilization.

Reference Books:

1. SUSE Cloud, Novell Inc., USA, 2016.
2. John W. Rittinghouse, James F. Ransome, Cloud Computing - Implementation, Management and Security, CRC Press, 2010. 978-1439806807
3. Tom White, Hadoop the Definite Guide, O'REILLY, 2009.978-1-4493-1152-0
4. Judith Hurich, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley Publication Inc., 2010.978-0-470-48470-8
5. George Reese, Cloud Application Architectures, O'REILLY, 2009.978-0-596-15636-7
6. Tim Mather, SubraKumarasamy, ShahedLatif, Cloud Security and Privacy, O'REILLY, 2009. 978-0-596-80276-9
7. Introduction to Cloud Computing Architecture, White paper, SUN, Microsystems, 1st edition, June 2009.

17CS3011 COMPUTING SECURITY LAB

Credits: 0:0:2
Co-requisite: 17CS3024 Security in Computing

Course Objectives:
Enable the student to
- implement various substitution and transposition ciphers.
- implement Key management and exchange algorithms.
- implement Digital Signatures and certificates.
- implement Hashing algorithms and Secure Electronic Transactions.

Course Outcomes:
The student will be able to
- relate the substitution and transposition techniques used for secure data transmission.
- defend the network with in-depth understanding of various cryptographic techniques.
- apply the various cryptographic algorithms for key management and key exchange.
- experiment the integrity of the message through hashing algorithms.
- formulate an environment to prove the digital signatures.
- summarize the ciphers and their related security services.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS3012 DESIGN AND ANALYSIS OF ALGORITHMS

Credits: 3:0:0

Course Objectives:

Enable the student to

- provide an introduction to advanced algorithms and its complexities
- analyses the efficiency of various algorithms using advanced algorithmic techniques
- design efficient algorithms using various design techniques

Course Outcomes:

The student will be able to

- state the correctness of the basic algorithms for the classic problems.
- understand the mathematical foundation in analysis of algorithms
- analyze the efficiency of algorithms using time and space complexity
- understand different algorithmic design strategies
- apply and implement learned algorithmic design strategies to solve problems
- developing efficient algorithms of various problems in different domains

Unit I - Introduction: Role of Algorithms in computing - Insertion sort - Analyzing algorithms - Designing algorithms - Growth of Functions - Recurrences - Probabilistic Analysis and Randomized Algorithms.

Unit II - Sorting techniques: Heapsort - Maintaining and building the heap - The heapsort algorithm-priority Queues - Quicksort - description - performance - randomized version - analysis - Sorting in Linear Time - Elementary Data Structures - Hash Tables - Binary Search Trees.

Unit III - Trees: Red-Black Trees - properties - rotations - insertions - deletions - Dynamic Programming - Greedy Algorithms - aggregate analysis - the accounting method - the potential method - Dynamic tables - B-Trees - basic operations - deletion.

Unit IV - Graph: Elementary Graph Algorithms - representations - BFS - DFS - Topological sort - Strongly connected components - Minimum Spanning Trees - Single-Source Shortest Paths - Shortest path and matrix multiplication - The Floyd Warshall algorithm - Johnson's algorithm for sparse graphs.

Unit V - Introduction to linear programming: Standard and slack forms - Formulating problems as linear programs - The simplex algorithm - Duality - The initial basic feasible solution - Polynomials and the FFT -NP-completeness.

Reference Books:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms, Third edition PHI Learning, 2010. ISBN: 10: 8120340078. ISBN: 8120321413.
2. Jeffrey Mcconnell, "Analysis of Algorithm", Jones and Battlet, 2008. ISBN-10: 0-7637- 0782-1.
3. A.V. Aho, J. E. Hopcroft and J. D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education Asia, 2003. *ISBN*-10: 0201000296.
4. Sara Baase and Allen Van Gelder, "Computer Algorithms - Introduction to Design and Analysis", Pearson Education Asia, 2003. *ISBN*-10: 0201612445
6. Michael T. Goodrich, Roberto Tamasia, Algorithm Design, First Edition, John Wiley and sons, 2001. ISBN: 0471383651

17CS3013 DISTRIBUTED SYSTEMS

Credits: 3:0:0

Course Objectives:

Enable the student to

- describe the concepts of resource sharing, system modeling, inter-process communication and file systems in distributed systems.
- apply the skill sets in name services and global states, distributed transaction and concurrency control model, distributed shared memory and distributed multimedia system.
- compare the replication techniques and shared memory schemes in distributed systems.

Course Outcomes:

The student will be able to

- describe the distributed system models.
- distinguish between different inter-process communication mechanisms and their application scenarios.
- illustrate a transaction and concurrency control scheme for a real time application.
- compare the various file system architectures used in distributed systems..
- construct a real time distributed system with suitable IPC, event coordination, file management, name service, transaction and concurrency control mechanisms.
- evaluate an efficient distributed system and its qualities.

Unit I - Introduction: Introduction to Distributed systems - Examples of distributed systems, resource sharing and the web, challenges - System model - introduction - architectural models - fundamental models - Introduction to inter-process communications - API for Internet protocol - external data.
Unit II - Distributed objects and file systems: Introduction - Communication between distributed objects - Remote procedure call - Events and notifications - case study - Operating system support - introduction - operating system layer - protection - process and threads - communication and invocation - architecture - Introduction to DFS - File service architecture - Sun network file system - Andrew file system - Enhancements and future developments.
Unit III - Name services and global states: Introduction to Name Services- Name services and DNS - Directory services - case study - Introduction to peer-to-peer systems - Napster Department of Computer Science and Engineering 4 and its legacy - Peer-to-peer middleware - Routing overlays - case study - Introduction to time and global states - Clocks, Events and Process states - Synchronizing physical clocks - Logical time and logical clocks - Global states - Distributed debugging.
Unit IV - Distributed transaction and concurrency control: Introduction to coordination and agreement - Distributed mutual exclusion - elections - multicast communication - consensus and related problems - Introduction to transaction and concurrency control - Transactions - Nested transaction - Locks - Optimistic concurrency control - Timestamp ordering - Comparison of methods for concurrency control - Introduction to distributed transactions - Flat and nested distributed transactions - Atomic commit protocols - Concurrency control in distributed transactions - Distributed deadlocks - Transaction recovery.
Unit V - Replication, distributed shared memory and distributed multimedia system: Introduction to Replication - System model and group communications - Fault tolerant services - Highly available services - Transactions with replicated data - Distributed shared memory - design and implementation issues - sequential consistency and Ivy - release consistency and Munin - other consistency models- Distributed multimedia systems - characteristics of multimedia data - quality of service management - resource management - stream adaptation - case study.

Reference Books:

1. George Coulouris, Jean Dollimore, and Tim Kindberg, Distributed Systems Concepts and Design, Fifth edition, Addison-Wesley, 2011. ISBN: 0132143011.
2. Andrew S. Tanenbaum and Maartenvan Steen, Distributed Systems: Principles and Paradigms, Second edition, Prentice Hall, 2006. ISBN: 0132392275.
3. William Buchanan, Distributed Systems and Networks, McGraw-Hill, 2001.ISBN: 0077095839.
4. Pradeep K. Sinha, Distributed Operating Systems: Concepts and Design, Wiley- IEEE Press, 1996. ISBN: 0780311191.

17CS3014 INFORMATION STORAGE MANAGEMENT

Credits: 3:0:0

Course Objectives:
Enable the student to
- understand storage networking technologies such as FC-SAN, NAS, IP-SAN and data archival solution - CAS.
- define information security and storage security domains.
- analyze logical and physical components of a storage infrastructure including storage subsystems.
- discriminate different storage virtualization technologies and their benefits.
- evaluate parameters of managing and monitoring storage infrastructure and describe common storage management activities and solutions.

Course Outcomes:
The student will be able to

- describe the different storage networking technologies.
- discuss different storage virtualization technologies and storage security domains.
- relate the different fiber channel ports.
- identify the various components of a storage system environment.
- design business continuity solutions including recovery technologies and remote replication solutions.
- interpret the physical and logical components of a storage infrastructure along with the parameters of managing and monitoring elements.

Unit I - Storage System: Information Storage - Evolution of Storage Technology and Architecture - Data Centre Infrastructure - Key Challenges in Managing Information - Information Lifecycle , Storage System Environment- Components of a Storage System Environment - Disk Drive Components - Disk Drive Performance - Fundamental Laws Governing Disk Performance - Logical Components of the Host - Application Requirements and Disk Performance, Data Protection - RAID- Implementation of RAID - RAID Array Components - RAID Levels - RAID Comparison - RAID Impact on Disk Performance - Hot Spares.
Unit II - Storage Networking: Components of an Intelligent Storage System - Intelligent Storage Array - Direct Attached Storage and Introduction to SCSI- Types of DAS - DAS Benefits and Limitations - Disk Drive Interfaces - Introduction to Parallel SCSI - SCSI Command Model, Storage Area Networks- Fibre Channel Overview - The SAN and its Evolution - Components of SAN - FC Connectivity - Fibre Channel Ports - Fibre Channel Architecture - Zoning - Fibre Channel Login Types - FC Topologies.
Unit III - Network Attached Storage and Content Addressed Storage: General Purpose Servers vs NAS Devices - Benefits of NAS - NAS File I/O - Components of NAS - NAS Implementations - NAS File Sharing Protocols - NAS I/O Operations - Factors affecting NAS Performance and Availability, IP SAN- iSCSI - FCIP, Content Addressed Storage - Fixed Content and Archives - Types of Archives - Features and Benefits of CAS - CAS Architecture - Object Storage and Retrieval in CAS - CAS Examples, Storage Virtualization- Forms of Virtualization - SNIA Storage Virtualization Taxonomy - Storage Virtualization Configurations - Storage Virtualization Challenges - Types of Storage Virtualization.
Unit IV - Business Continuity: Information Availability - BC Terminology - BC Planning Life Cycle - Failure Analysis - Business Impact Analysis - BC Technology Solutions, Backup and Recovery- Backup Purpose - Backup Considerations - Backup Granularity - Recovery Considerations - Backup Methods - Backup Process - Backup and Restore Operations - Backup Topologies - Backup in NAS Environments - Backup Technologies, Local Replication- Source and Target - Uses of Local Replicas - Data Consistency - Local Replication Technologies - Restore and Restart Considerations - Creating Multiple Replicas - Management Interface, Remote Replication - Modes of Remote Replication - Remote Replication Technologies - Network Infrastructure.
Unit V - Storage Security and Management: Storage Security Framework - Risk Triad - Storage Security Domains - Security Implementations in Storage Networking, Managing the Storage Infrastructure - Monitoring the Storage Infrastructure - Storage Management Activities - Storage Infrastructure Management Challenges - Developing an Ideal Solution

Reference Books:

1. EMC Corporation, Information Storage and Management, Wiley Publishing Inc. USA, 2009, ISBN 978-81-265-2147-0.
2. Tom Clark, Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs, Addison Wesley, Second Edition, 2003, ISBN 978-0321136503.
3. Robert Spalding, Storage Networks: The Complete Reference, Tata McGraw Hill, 2008, ISBN 978-0-07-053292.
4. MeetaGupta, Storage Area Network Fundamentals, Cisco Press, 2002,ISBN 1-58705-065.

17CS3015 INTERNETWORKING

Credits: 3:0:0
Course Objectives:
Enable the student to

- understand the layers of TCP/IP and how all protocols in the TCP/IP suite fit into the five-layer model.
- identify the possibilities of interconnecting multiple physical networks into a coordinated system.

- summarize the details of the global TCP/IP internet including the architecture of its router system and the application protocols it supports.
- describe the working principles of Multiprotocol Label Switching.

Course Outcomes:

The student will be able to

- identify the various TCP/IP protocols used for the networking application.
- distinguish the use of interior and exterior routing protocols used for different networks.
- demonstrate the working of various protocols in internetworks.
- analyze the behaviour of internetworking different networks in MPLS networks.
- relate the switching and forwarding operations of internetworks.
- summarize the applications of various protocols used in internetworks.

Unit I - Introduction to TCP/IP - Layering - Link Layer - IP Internet Addresses - IP Internet Protocols- IP Header - IP Routing - Subnet Addressing - Subnet Mask - Special Case IP Address - A Subnet Example - ifconfig Command - netstat Command - IP Futures.

Unit II - Link Layer: Address Resolution Protocol- ARP Cache - ARP Packet Format - ARP Examples - Proxy ARP - Gratuitous ARP - arp Command- Reverse Address Resolution Protocol - RARP Packet Format - RARP Examples - RARP Server design - Internet Control Message Protocol - ICMP Message Types - ICMP Address Mask Request and Reply - ICMP Timestamp Request and Reply - ICMP Port Unreachable Error - 4.4BSD Processing of ICMP Messages.

Unit III - IP Routing - Routing Principles - ICMP Host and Network Unreachable Errors - To Forward or Not to Forward - ICMP Redirect Errors - ICMP Router Discovery Messages - Dynamic Routing Protocols - Unix Routing Daemons - RIP: Routing Information Protocol - RIP Version 2 - OSPF: Open Shortest Path First - BGP: Border Gateway Protocol - CIDR: Classless Interdomain Routing - User Datagram Protocol - UDP Header - UDP Checksum - A Simple Example - IP Fragmentation - ICMP Unreachable Error (Fragmentation Required) - Determining the Path MTU Using Traceroute - Path MTU Discovery with UDP - Interaction Between UDP and ARP - Maximum UDP Datagram Size - ICMP Source Quench Error - UDP Server Design.

Unit IV - Broadcasting and Multicasting - Broadcasting - Broadcasting Examples - Multicasting - IGMP Message - IGMP Protocol - An Example - IGMP - DNS - DNS Basics - DNS Message Format- A Simple Example - Pointer Queries - Resourse Records - Caching - UDP or TCP - TFTP Protocol - An Example- Security - BOOTP - BOOTP Packet Format - BOOTP Server Design - BOOTP Through a Router - Vendor-Specific Information - TCP Protocol - TCP Services - TCP Header - SNMP Protocol - Protocol - Structure of Management Information - Object Identifiers - Introduction to the Management Information Base - Instance Identification - Simple Examples- Management Information Base - Telnet and Rlogin - FTP Protocol - SMTP Protocol - NFS Protocol.

Unit V - MPLS Switching Introduction - Label Switching Basics - Switching and Forwarding Operations - MPLS Key Concepts - Label Distribution Operations - MPLS and ATM and Frame Relay Networks - Traffic Engineering- OSPF in MPLS Networks.

Reference Books:

1. W. Richard Stevens, TCP/IP Illustrated Volume - I, The Protocols, Second Edition, Addison-Wesley, 2011. ISBN: 978-0321336316.
2. Uyless Black, MPLS and Label Switching Networks, Pearson Education, Second Edition, 2002. ISBN: 81-7808-650-6.
3. Behrouz A. Forouzan, TCP/IP Protocol Suite, Tata McGraw Hill, Fourth Edition, 2009. ISBN: 978-0073376042
4. Douglas E. Comer, Internetworking with TCP/IP - Principles, Protocols and Architecture, Pearson Education, Fifth Edition, 2007. ISBN: 978-81-203-2998-0.

17CS3016 INTERNETWORKING AND SECURITY LAB

Credits: 0:0:2

Course Objectives:

Enable the student to

- experiment TCP/IP protocols, Ethernet, virtual LAN, wireless LAN using packet tracer.
- configure the router with various intra and inter domain routing protocols.
- judge the performance and application of security algorithms.

Course Outcomes:
The student will be able to

- identify the various network devices and their functionalities in the network.
- classify the various TCP/IP protocols and their roles in the respective layers in the OSI model.
- apply the subnetting and supernetting techniques in the network and to implement an efficient network.
- experiment the Ethernet, virtual and wireless LAN techniques and analyze the performance of each technique.
- construct a network which is capable enough to overcome all the network related challenges through the above mentioned mechanisms.
- familiarize with the security algorithms implemented in networks to achieve the highly secure networks.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD and notify it at the beginning of the semester.

17CS3017 INTERNETWORKING LAB

Credits: 0:0:2
Co-requisite:17CS3015 Internetworking

Course Objectives:
Enable the student to

- identify network devices and their functions.
- understand the functionalities of Intra and Inter VLAN.
- configure and troubleshoot various routing protocols in internetworking.

Course Outcomes:
The student will be able to

- identify the different types of network devices and their functions within a network.
- predict the routing mechanisms, network interfaces and design / performance issues in local area networks and wide area networks.
- apply various Techniques for configuring Virtual LAN, Ethernet and Wireless LAN.
- analyze and trouble shoot various real time networks.
- design an operational network for any organization's requirement.
- familiarize with the basic protocols of computer networks, and evaluate how they can be used to assist in network design and implementation.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

17CS3018 MOBILE AD HOC NETWORKS

Credits: 3:0:0

Course Objectives:
Enable the student to

- familiarize with Ad Hoc networks.
- develop a comprehensive understanding of Ad Hoc TCP protocols.
- evaluate the performance of Ad Hoc routing protocols.

Course Outcomes:
The students will be able to

- describe the working of various protocols for Ad Hoc Wireless Networks.
- summarize the advantages and disadvantages of various protocols.
- illustrate the working of routing protocols for Ad Hoc Wireless Networks.
- analyze the design issues of MAC protocols and Routing protocols.
- categorize the QoS schemes, energy management schemes.
- predict the evolution of wireless networking technologies.

Unit I - Introduction to Ad Hoc Wireless Networks: Issues in Ad Hoc Wireless Networks - Ad Hoc Wireless internet - Issues in designing a MAC protocols for Ad Hoc Wireless Networks - classification of MAC protocols: content based protocol - Content based protocol with reservation Mechanisms - Content based protocol with scheduling Mechanisms - Mac protocols that use Directional Antennas.
Unit II - Routing Protocol for Ad Hoc Wireless Networks: Issues in Designing a Routing Protocol for Ad Hoc Wireless Networks - classification of Routing Protocols - Table-Driven Routing Protocols - On-Demand Routing Protocols - Dynamic source routing protocol - Ad Hoc on-Demand Distance Vector routing protocol - hybrid routing protocols - Routing Protocols with Efficient Flooding Mechanisms - hierarchical Routing Protocols - power-aware protocols,
Unit III - Quality of Service in Ad Hoc Wireless Networks: Issues and Challenges in Providing QoS in Ad Hoc Wireless Networks - Classifications of QoS Solutions - MAC Layer Solutions - Network Layer Solutions - QoS Frameworks for Ad Hoc Wireless Networks - Qos Routing protocol - bandwidth routing protocol - on-demand link state Multipath Qos Routing protocol.
Unit IV - Need for Energy Management in Ad Hoc Wireless Networks: Classification of Energy Management Schemes - Battery Management Schemes - Transmission Power Management Schemes - System Power Management Schemes - Wireless Sensor Network Architecture - Data Dissemination - Data Gathering - MAC Protocols for Sensor Networks - Location Discovery.
Unit V - Evolution of wireless mobile technologies: 2G mobile systems - 2.5G mobile wireless systems - 3G mobile wireless system - Core Network - 3G service and application - B3G challenge - GSM evolves to B3G - The future of AD Hoc Networking.

Reference Books:

1. Murthy, Ad Hoc Wireless Networks: Architectures and Protocols, Dorling Kindersley, 2012, ISBN-13: 9780133007060.
2. George Aggelou, Mobile Ad Hoc Networks from Wireless Lans to 4G Networks, Tata McGraw - Hill Education, 2009, ISBN-13: 9780070677487.
3. C-K Toh, Ah Hoc Mobile Wireless Network Protocols and System, Dorling Kindersley, 2007, ISBN-13:9788131715109.
4. Perkins, Ad Hoc Networking, Dorling Kindersley, 2008, ISBN-13: 9788131720967.
5. Stefano Basagni, Marco Conti, Silvia Giordano, Ivan Stojmenovic, "Mobile Ad Hoc Networking", Wiley India Pvt Ltd, 2010, ISBN-13: 9788126527892.
6. Gianluigi Ferrari, Ozan K. Tonguz, "Ad Hoc Wireless Networks: A Communication -Theoretic Perspective", Wiley, 2009, ISBN-13: 9788126523047.

17CS3019 MPLS AND VPN

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand, design, and deploy Multiprotocol Label Switching (MPLS)-based Virtual Private Networks (VPNs).
- learn MPLS theory and configuration, network design issues, and MPLS-based VPNs.
- get in-depth analysis of MPLS architecture.

Course Outcomes:
The student will be able to

- describe the MPLS architecture and its implementation on CISCO IOS Software in Frame mode and Cell mode scenarios.
- explain the advanced MPLS operation.
- demonstrate the configuration and troubleshooting of a MPLS network
- illustrate MPLS over Virtual Private Network implementation.
- design VPN based business applications.
- summarize MPLS/VPN architecture overview and operation.

Unit I - Multiprotocol Label Switching architecture overview: Scalability and Flexibility of IP based forwarding -Multiprotocol Label switching (MPLS) introduction - Frame mode MPLS operation- Cell mode MPLS Operation.

Unit II - Running Frame mode MPLS across Switched WAN Media-Frame mode MPLS operation across Frame Relay and ATM PVCs - Advanced MPLS Operation**.**

Unit III - Virtual Private Network Implementation options - Virtual Private Network Evolution - Business problem based VPN Classification -Overlay and Peer to Peer VPN Model - Typical VPN Network Topologies.

Unit IV - MPLS VPN Architecture overview - VPN routing and forwarding tables - overlapping virtual private networks - Route Targets - Propagation of VPN Routing information in the provider's network - VPN Packet Forwarding.

Unit V - MPLS VPN Architecture Operation: Configuration of VRFs - Route Distinguishers and VPN-IPV4 address prefixes -BGP extended commUnity attributes - Basic PE-CE Link configuration - Association of interfaces to VRFs - Multiprotocol BGP usage and deployment - Outbound route filtering and route refresh features - MPLS/VPN Data plane packet forwarding.

Reference Books:

1. Ivan Pepelnjak, Jim Guichard, "MPLS and VPN Architectures CCIP Edition", 2002, Cisco Press, ISBN: 1-58705-081-1
2. De Ghein, Luc. MPLS fundamentals. Cisco Press, 2016, ISBN: 0134575261.
3. Uyless Black, "MPLS and Label Switching Networks", Prentice Hall, 2002, 2nd edition, ISBN: 978-0130158239.
4. Sean Harnedy, "The MPLS Primer: An Introduction to Multiprotocol Label Switching", 2001, Prentice Hall, ISBN: 978-0130329806.
5. Ruixi Yuan, W. Timothy Strayer, "Virtual Private Networks: Technologies and Solutions", 2001, Addison-Wesley Professional, ISBN: 978-0201702095.
6. Dave Kosiur, "Building and Managing Virtual Private Networks"Wiley; ISBN: 978-0471295266.
7. Dennis Fowler, "Virtual Private Networks: Making the Right Connection", Morgan Kaufmann, 1999, ISBN: 978-1558605756

17CS3020 NETWORK DESIGN AND MANAGEMENT LAB

Credits: 0:0:2

Course Objectives:

Enable the student to

- to demonstrate the basics of designing a network, taking into consideration the users, services and locations of the hosts.
- to demonstrate various protocol used in network, application and transport layer.

Course Outcomes:

The student will be able to

- define and describe the basic network management concepts.
- distinguish between the various network layers protocols.
- apply and demonstrate various network addressing scheme for a network/subnet
- examine the incoming and outgoing packets in a network
- construct design for various types of network scenario
- evaluate various network layer protocols and LAN protocols

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

17CS3021 NETWORK MANAGEMENT

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the foundations required to build network management architectures and protocols.
- illustrate SNMP-based protocols that manage TCP/IP networks with real-world examples.
- infer about RMON and network management tools and web based management techniques.

Course Outcomes:

The student will be able to

- describe basic network management concepts.

- distinguish the characteristics and capabilities of various versions of SNMP.
- prepare and schedule suitable network management strategies.
- experiment and illustrate the usage of remote monitoring.
- plan the management of a network by using the appropriate management tools.
- compare and analyze various models of network management.

Unit I - Data communications and network management overview: analogy of telephone network management -data and telecommunication network -distributed computing environment -TCP/IP based networks -network management: goals -organization and functions -Network management organization and architecture
Unit II - SNMP and network management: standards -network management tools -organization model -information model -communication model -ASN.1
Unit III - SNMPv1 network management: Organization and information models: internet organization and standards -SNMP model -organizational model -system overview
Unit IV - SNMP management SNMPv2: major changes in SNMPv2 -SNMPv2 system architecture -structure of management information -management information base -SNMPv2 protocol -compatibility with SNMPv1 -management SNMPv3: key features -documentation architecture -SNMPv3 applications -SNMPv3 MIB -security -user-based security model
Unit V - SNMP management: RMON -introduction -RMON SMI and MIB -RMON1 -RMON2 -network management tools -systems and engineering: system utilities -network statistics measurements system -MIB engineering -network management applications: configuration management -fault management -performance management -security management -accounting management -report management.

Reference Books:

1. Mani Subramanian, Network Management Principles and Practice, Addison Wesley, 2012. ISBN: 9788131727591.
2. Sebastian Abeck, Adrian Farrel, Network Management Know it all, Elsevier Morgan Caufmann, 2009. ISBN: 9780123745989.
3. Stephen B. Morris, Network Management, MIBs and MPLS: Principles Design and Implementation, Pearson, 2008. ISBN-10: 0131011138, ISBN-13: 9780131011137.
4. Alexander clemm, Network Management Fundamentals, CISCO Press, 2006. ISBN: 1587201372.
5. Andrew S.Tanenbaum, Computer Networks, Pearson Education, Limited, 2011.

17CS3022 OBJECT ORIENTED SOFTWARE ENGINEERING

Credits: 3:0:0

Course Objectives:
Enable the student to

- infer knowledge in both the principles of software engineering as well as the practices of various object-oriented tools, processes, and products.
- design and construction of modular, reusable, extensible and portable software using object oriented programming languages.
- analyze principles of object-oriented software engineering, from analysis through testing

Course Outcomes:
The student will be able to

- recognize and specify software requirements through a productive working relationship with various stakeholders of the project.
- convert a specification into a design, and then realize that design practically, using an appropriate software engineering methodology.
- use modern engineering tools necessary for software project management, time management and software reuse.
- compare and contrast various software life cycle models.
- plan a software engineering process life cycle, including the specification, design, implementation, and testing of software systems that meet specification, performance, maintenance and quality requirements.
- evaluate the quality of the requirements, analysis and design work done during the module.

Unit I - Introduction to Software engineering: What is Software Engineering - Software Engineering Concepts - Software Engineering Development Activities - Managing Software Development -Modeling with UML: Introduction - Overview of UML - Modeling Concepts - Deeper View into UML.
Unit II - Project Organization and Communications: Introduction - An Overview of Projects - Project Organization Concepts - Project Communication Concepts - Organizational Activities. Analysis: Introduction - Overview of Analysis - Analysis Concepts - Analysis Activities - Managing Analysis.
Unit III - System Design: Overview of System Design - System Design Concepts - System Design activities - Managing System Design. Object Design- Overview of Object design - Reuse Concepts - Reuse Activities - Managing Reuse.
Unit IV - Mapping Models to Code: Overview of mapping - Mapping concepts - Mapping Activities - Mapping Implementation. Configuration Management and Project Management: Configuration Management Overview-Concepts-Activities and Managing Configuration Management - Overview of Project management - Project Management Concepts - Project Management Activities.
Unit V - Software Life Cycle: Introduction - IEEE 1074 - Characterizing the Maturity to Software Life Cycle Models - Life cycle Models. Methodologies: Introduction - Project environment - Methodology Issues - A Spectrum of Methodologies.

Reference Books:

1. Bernd Bruegge and Allen Dutoit, Object-Oriented Software Engineering: Practical software development using UML, Patterns and java, third Edition, Pearson Education, 2013, ISBN: 1292037091, 9781292037097.
2. Bernd Bruegge and Allen H. Dutoit, Object-Oriented Software Engineering: Conquering Complex and Changing Systems, Pearson Education, 2002. ISBN 0-13-489725-0.
3. George Wilkie, Object-oriented Software Engineering: The Professional Developer's Guide, Addison-Wesley, 1993. ISBN-10: 0201627671.
4. Timothy C. Lethbridge and Robert Laganiere, Object-Oriented Software Engineering: Practical software development using UML and Java, McGraw-Hill Higher Education, 2005. ISBN: 0077109082.

17CS3023 ROUTING AND SWITCHING TECHNIQUES

Credits: 3:0:0

Objectives
Enable the student to

- learn the virtual LAN concepts and its applications.
- get exposure into Switch Management and Network Troubleshooting Strategies.
- understand the most popular routing protocols - RIPv1 and RIPv2, EIGRP, OSPFv2.
- know the route redistribution and on-demand routing.

Course Outcomes:
The student will be able to

- select appropriate routing protocols and configurations for various scenario of network.
- estimate the security vulnerabilities in LAN.
- operate and troubleshoot VLAN and optimize their performance.
- analyze the dynamic routing protocolsto configure and troubleshoot them.
- plan loop resolution methods in LAN environment.
- describe the route redistribution and on-demand routing concepts.

Unit I - Routing Basics: TCP/IP Review -TCP/IP protocol layers -IP packet header -IP addresses -ARP -ICMP -IPv6 Overview -Static Routing -route table -configuring static routes -troubleshooting static routes -Dynamic Routing Protocols: routing protocol basics -distance vector routing protocols -link state routing protocols -interior and exterior gateway protocols -
Unit II - Interior Routing Protocols: Routing Information Protocol (RIP) -operation of RIP -configuring RIP -troubleshooting RIP -operation of RIPv2 -configuring RIPv2 -troubleshooting RIPv2 -classless routing -Enhanced Interior Gateway Routing Protocol (EIGRP) -operation of EIGRP -configuring EIGRP -troubleshooting EIGRP -OSPFv2 -Route Control and Interoperability: Route Redistribution -Default Routes and On-Demand Routing

Unit III - LAN Switching: network architecture -addressing -LAN technologies -IEEE LAN standards -Transparent Bridges -principles -architecture -implementing the Bridge Address Table -performance -Bridging Between Technologies -Principles of LAN Switches -switched LAN concepts -multilayer switches
Unit IV - Loop Resolution: spanning tree protocol -rapid spanning tree protocol -configuring spanning tree -source routing overview -source routing operations -interconnecting the source-routed and transparently bridged universes
Unit V - Advanced LAN Switch Concepts: full duplex operation -LAN and switch flow control -link aggregation -Virtual LANs: Applications and Concepts -VLAN concepts -awareness -association rules -LAN Security: overview -LAN security concerns.

Reference Books:

1. Jeff Doyle, Routing TCP/IP Volume-1, Second edition, Pearson Education Singapore Pvt Ltd, 2006, ISBN: 9788131700426.
2. Rich Seifert, James Edwards, The All-New Switch Book - The Complete Guide to LAN Switching Technology, Second edition, Wiley publication, 2008, ISBN:978-1-4571-2740-3.
3. Barnes D, Cisco LAN Switching Fundamentals Pearson Education, 2008, ISBN: 9781587058493.
4. Stephen A. Thomas, IP Switching and Routing Essentials: Understanding RIP, OSPF, BGP, MPLS, CR-LDP, and RSVP-TE, Wiley publication, 2001, ISBN: 978-0-471-03466-7
5. Bruce Hartpence, Packet Guide to Routing and Switching, O'Reilly Media, 2011, ISBN: 9781449306557.

17CS3024 SECURITY IN COMPUTING

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the security threats in computing
- determine the necessary control measures to prevent the threats.
- develop skills to design trusted operating systems.

Course Outcomes:
The student will be able to

- identify the factors driving the need for security.
- discuss security issues in operating systems
- apply computer security in data and databases
- analyze the possibilities in securing the network.
- Categorize human initiated and computer initiated threats.
- assess security planning and policies

Unit I - Program Security: Introduction to security in computing - Introduction to elementary cryptography - Program security - Unintentional programming oversights - Malicious code - Countermeasures.
Unit II - Operating System Security: Protection in general purpose operating systems - Security in the design of operating system - Designing trusted operating systems.
Unit III - Network Security: Network concepts - Threats to network communications - Wireless network security - Denial of service - Distributed denial-of-service - Cryptography in network security - Firewalls - Intrusion detection and prevention systems - Network management.
Unit IV - Database Security: Introduction to Databases - Security requirements of databases - Reliability and integrity - Database disclosure - Data mining and big data.
Unit V - Cloud Computing & Security Planning: Cloud computing concepts - Moving to the cloud - Cloud security tools and techniques - Cloud identity management - Securing IaaS - Security planning - Business continuity planning - Risk Analysis - Dealing with disaster.

Reference Books:

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Jonathan Margulies, Security in Computing, Fifth Edition, Pearson Education, 2015. ISBN-13: 978-0-13-408504-3.
2. Dieter Gollmann, Computer Security, Second edition, John Wiley and Sons, 2006. ISBN:81- 265-0690-3.
3. William Stallings, Cryptography and Network Security, Fourth edition, Prentice Hall, 2006. ISBN: 0-13-147954-7.

4. Paul Campbell, Ben Calvert, Steven Boswell, Security + In Depth, International Student Edition, and 2005. ISBN: 0-619-21566-6.
5. John Aycock, Computer Viruses and Malware, Springer, 2006, ISBN: 0387302360.
6. Bruce schneier, Applied Cryptography, Second Edition, John Wiley and Sons, 2002. ISBN: 9971-51-348-X.

17CS3025 SYSTEM ADMINISTRATION

Credit: 3:0:0

Course Objectives:

Enable the student to

- guide through the basics of Linux Technology and to train as a System Administrator
- understand the structure of the Linux file system and how to work in the file system.
- learn how to work with Linux shell and command line interface.
- familiarize Kernel Components and System Management.
- establish a Network and Secure Network Services.
- learn how to manage software with RPM.

Course Outcomes:

The student will be able to

- select the needed desktop environment and work with it.
- identify the hierarchy of linux file system and the associated file operations.
- apply the right commands to perform tasks associated with users, software packages, disk partitions and quotas.
- outline the tasks performed through YaST.
- categorize the run levels and the bootup procedure.
- choose the correct backup strategy.

Unit I - What is SUSE Linux Enterprise?: Install SLES12 - Understand the GNOME Desktop -Understand YaST - Understand the Filesystem Hierarchy Standard - Get to Know the Linux File Types - Work with the Command Line - Define and Explain the Shell Environment -Commands - Help-Vi Text Editor - Use OpenSSH for Command Line Remote Administration.

Unit II - System Initialization: Define and List the SLE12 Boot Process - Define and Explain UEFI, Secure Boot and Trusted Execution - Configure the GRUB2 Bootloader - Define and Manage Services with systemd.

Unit III - Process Management: Manage Processes-Work with Background Processes - Schedule Processes - Identity and Security - Manage Users and Groups - Change File Permissions -Delegate Privileges.

Unit IV - Manage Software: Manage RPM Packages - Manage Software Repositories and Libzypp Network Management - Use Basic Network Commands - Configure Network Interfaces - Manage Network with Wicked - Set Up SUSEfirewall2.

Unit V - Storage: Configure Partitioning (MBR and GPT) - Recognize Traditional Linux File Systems - Introduction to BtrFS - Configure Software RAID - Configure Logical Volume Management (LVM) - Administration and Monitoring - Configure Time Synchronization - Configure System Logging - Use Support config.

Reference Books:

1. SUSE ® Linux Enterprise Server 12 Administration, SUSE 2016.
2. Suse Linux, Novell Inc., USA.
3. Nicholas Wells, The Complete Guide to LINUX System Administration, Indian Edition, Cengage Learning, 2005, ISBN:0619216166.
4. Evi Nemeth, Garth Snyder, Trent R. Hein , Linux administration handbook, Second Edition, Pearson Education, 2007, ISBN 0-13-148004-9.
5. Tom Adelstein, Bill Lubanovic, Linux System Administration, O'Reilly Media Inc., First Edition, 2007, ISBN -13:978-0-596-00952-6.
6. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Unix and Linux System Administration handbook, Fourth Edition 2010, Pearson Education, ISBN 0132117363.

17CS3026 SYSTEM ADMINISTRATION LAB

Credit: 0:0:2
Co-requisite: 17CS3025 System Administration
Course Objectives:
Enable the student to

- experiment SUSE Linux Enterprise basic installation, configuration and initialization.
- experience SUSE Linux Enterprise Server management.
- manage storage, network and network services.

Course Outcomes:
The student will be able to

- describe SUSE Linux System initialization and booting
- review server monitoring and Hardware management
- use command line and yast for the server configuration
- examine installation and configuration of the SUSE Enterprise Linux for the production environment
- create identity, security and manage processes
- assess software, network and storage management

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS3027 SYSTEM DEVELOPMENT LAB

Credits: 0:0:2
Co-requisite:17CS3022 Object Oriented Software Engineering

Course Objectives:
Enable the student to

- develop an application using different life cycle models.
- how to carry out requirement dictation process.
- architectural and detailed design methods.

Course Outcomes:
The student will be able to

- identify the various requirements in a system.
- distinguish various software lifecycle models.
- practice design methods to provide collaborative services to the customers.
- test the process of verification and validation of the project.
- develop innovative ideas for the problems indifferent applications.
- evaluate every applications based upon the quality design work on regular basis.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS3028 WIRELESS NETWORKS LAB

Credits: 0:0:2

Course Objectives:
Enable the student to

- simulate various communication and mobility models of wireless networks.
- understand the characteristics of wireless MAC Protocols.
- analyze the performance of wireless routing protocols.

Course Outcomes:
The student will be able to

- describe the working of various protocols in wireless mobile ad hoc networks.
- summarize the steps to setup wireless network scenarios using NS2 and analyze the simulation results.
- model network topologies for the selected protocols and technologies, including internetworking with routers and routing protocols.

- demonstrate the packet flow, packet drop visually for the wireless ad hoc networks.
- calculate the performance metrics of protocols in wireless mobile ad hoc networks.
- justify the performance comparison between routing protocols in wireless mobile ad hoc networks.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

17CS3029 WIRELESS SENSOR NETWORKS

Credits: 3:0:0

Course Objectives:
Enable the student to
- understand the basic concepts of wireless sensor network (WSN) and its applications.
- explain different wireless technologies and wireless MAC protocols.
- infer knowledge of simulators and operating systems for WSN.

Course Outcomes:
The student will be able to
- identify important aspects of WSN and its benefits.
- discuss the various design issues in development of WSN and their applications.
- illustrate the working principles of a WSN.
- compare and contrast different wireless technologies and wireless MAC protocols.
- plan to integrate sensors into systems for deployment and improve performance.
- evaluate the performance of WSN protocols using appropriate simulators.

Unit I - Introduction and overview of Wireless Sensor Networks: Background of Sensor Network Technology - Application of Sensor Networks - Basic overview of the technology - Basic Sensor Network Architectural Elements - Survey of Sensor Networks - Applications of Sensor Networks: Range of Applications - Examples of Category 2 WSN Applications - Examples of Category 1 WSN Applications - Taxonomy of WSN Technology.
Unit II - Basic Wireless Sensor Technology: Sensor Node Technology - Sensor Taxonomy - WN Operating Environment - WN Trends - Wireless Transmission Technology and Systems: Radio Technology Primer - Propagation and Propagation Impairments - Available Wireless Technologies - Campus Applications - MAN/WAN Applications.
Unit III - Medium Access Control Protocols for Wireless Sensor Networks: Fundamentals of MAC Protocols - Performance Requirements - Common Protocols - MAC Protocols for WSNs - Sensor-MAC Case Study - IEEE 802.15.4 LR - WPANs Standard Case Study - PHY Layer - MAC Layer. Routing Protocols for Wireless Sensor Networks: Data Dissemination and Gathering - Routing Challenges and Design Issues in Wireless Sensor Networks - Routing Strategies in Wireless Sensor Networks.
Unit IV - Query Processing and Data Aggregation: Query Processing in Wireless Sensor Networks - Data Aggregation in Wireless Sensor Networks - Transport Control Protocols for Wireless Sensor Networks: Traditional Transport Control Protocols - Transport Protocol Design Issues - Examples of Existing Transport Control Protocols - Performance of Transport Control Protocols. Network Security and Attack Defense: Confidentiality - Integrity - Authenticity - Nonrepudiation - Freshness - Availability - Intrusion detection - Key management - Middleware for Wireless Sensor Networks: WSN Middleware Principles - Middleware Architecture - Existing Middleware.
Unit V - Network Management for Wireless Sensor Networks: Traditional Network Management Models - Network Management Design Issues - Example of Management Architecture: MANNA - Naming - Localization. Operating Systems for Wireless Sensor Networks: Design Issues - Examples of Operating Systems - Performance and Traffic Management: WSN Design Issues - Performance Modelling of WSNs - Case Study: Simple Computation of the System Life Span.

Reference Books:

1. KazemSohraby, Daniel Minoli and TaiebZnati, Wireless Sensor Networks: Technology, Protocols, and Applications, John Wiley and Sons, 2011, ISBN: 9788126527304, 8126527307
2. Jun Zheng, Abbas Jamalippur, Wireless Sensor Networks: A Networking Perspective, John Wiley and Sons, 2014, ISBN: 978-81-265-5124-8.

3. WalteneousDargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice, John Wiley and Sons, 2010, ISBN: 978-0-470-997659.
4. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley and Sons, 2007, ISBN: 978-0471718161.

17CS3030 3D MODELING AND RENDERING

Credits: 3:0:0

Course Objectives:
Enable the student to

- identify 3D modeling and various approaches for visualizing models.
- illustrate fundamentals of texture mapping, methods for rendering the graphics scene and techniques used to composite images.
- compare various lighting techniques for rendering the 3D scene

Course Outcomes:
The student will be able to

- recognize shading models for flat and smooth surface.
- classify the concepts of 3D modelling and various approaches for visualizing models.
- demonstrate the functions like blending and transparency.
- analyze color quantization and uniform quantization algorithms for color theory.
- summarize the HSR method for scan line, list priority and curved surface.
- compare and contrast ray tracing models

Unit I - Rendering faces for visual realism - - Introduction to shading models - Flat shading and smooth shading - Removing hidden surfaces - Adding texture to faces - Adding shadows of objects - Tools for raster displays - Introduction - Manipulating pixmaps - Combining pixmaps - Bresenham's line drawing algorithms - Defining and filling regions of pixels - Manipulating symbolically defined regions - Filling polygon defined regions - Aliasing and antialiasing technique - Creating more shades and colours.
Unit II - Curve and surface design - Introduction - Describing curves by means of polynomials - Interactive curve design - Bezier curves for curve design - Finding better blending functions - The B-Spline basis functions and useful properties- BSpline for design - Rational Splines and NURBS curves - A Glimpse at interpolation - Modeling curvedsurfaces
Unit III - Color theory - Introduction-describing colors - The international commission on Illumination standard - Color spaces - Color quantization - Uniform quantization - The popularity algorithm - Median cut algorithm - Octree quantization.
Unit IV - Hidden surface removal - Introduction - The depth buffer algorithm revisited - List priority HSR method - Scan line HSR method - Area subdivision approaches - On hidden line removal methods - HSR method for curved surfaces.
Unit V - Ray tracing - Introduction - Setting up the geometry of ray tracing - Overview of the ray tracing process - Intersection of a ray with an object - Organizing a ray tracer application - Intersecting rays with other primitives - Drawing shaded pictures of scenes - Adding surface texture - Extents - Adding shadows for greater realism - Reflections and transparency - Compound objects: Boolean operations on objects

Reference Books:

1. Tom McReynolds, David Blythe, Advanced Graphics Programming Using OpenGL, Elsevier Publications, 2005, ISBN: 0080475728, 9780080475721.
2. Francis S. Hill, Stephen M. Kelley, Computer graphics using Open GL, Third Edition, Pearson Prentice Hall, 2007, ISBN: 0131362623, 9780131362628.
3. Donald Hearn, M. Pauline Baker, Computer Graphics with OpenGL, Third Edition, Pearson Education India, 2004 , ISBN: 8131727386, 9788131727386.
4. Nikos Sarris, Michael G. Strintzis, 3D Modeling and Animation: Synthesis and Analysis Techniques for the Human Body, Idea Group Inc (IGI), 2005, ISBN: 1591402999, 9781591402992
5. Tom Capizzi, Inspired 3D Modeling and Texture Mapping, , 2002, Cengage Learning ISBN: 1931841500, 9781931841504

17CS3031 ADVANCED DATA MINING

Credits: 3:0:0

Course Objectives:

Enable the student to

- provide an in-depth knowledge of data mining concepts, algorithms and performance measures.
- get an insight of efficiency of data mining algorithms in solving practical problems.
- provide hands-on experience in commercial data mining tools.

Course Outcomes:

The student will be able to

- state different applications of data mining.
- summarize different classification and clustering algorithms of data mining.
- apply appropriate algorithm to give solution for practical problems.
- analyze the performance of a classifier.
- prepare the data for mining process.
- estimate the performance of different algorithms in data mining.

Unit I - Data Mining and Machine Learning: Simple examples - Fielded applications - machine learning and statistics - Generalization as search - Data mining and ethics. Input: Concepts, instances, and attributes. Output: Knowledge representation.

Unit II - Algorithms: Inferring rudimentary rules - Statistical modeling - Divide-and-conquer - Covering algorithm - Mining association rules - Linear model - Instance-based learning - clustering.

Unit III - Credibility: Training and testing - predicting performance, - cross-validation - other estimates - comparing data mining methods - predicting probabilities - counting cost - evaluating numeric prediction - The minimum description length principle - Applying the MDL principle to clustering.

Unit IV - Implementations: Real machine learning schemes: Decision trees - Classification rules - Clustering - Bayesian networks. Extension and applications.

Unit V - THE WEKA Machine Learning Workbench: Introduction-The Explorer - The Knowledge Flow Interface.

Reference Books:

1. Jiawei Han, Micheline Kamber, Data Mining Concepts and Techniques, Chris Ullman, Morgan Kaufmann Publishers,Third Edition, 2011, ISBN 0123814790, ISBN-13 9780123814791.
2. Ian H. Witten, Eibe Frank, Data Mining Practical Machine Learning Tools and Techniques,Elsevier, Third Edition, 2011, ISBN: 978-012-374856-0.
3. David Hand, Heikki Mannila and Padhraic Smyth, Principles of Data Mining, The MIT Press, 2001. ISBN-10: 026208290X
4. Max Bramer, Principles of Data Mining, Springer, 2013 ISBN -1447148843
5. Bertrand Clarke, Ernest Fokoue, Hao Helen Zhang, Principles and Theory for Data Mining and Machine Learning, Springer, 2009, ISBN-0387981357

17CS3032 APPLIED MEDICAL IMAGE PROCESSING

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the basics of medical image datasets and the special requirements for processing medical imaging data.
- recognize the need of image processing techniques for clinical applications.
- apply various imaging techniques like transformations, rendering, registration, and reconstruction on medical images.

Course Outcomes:

The student will be able to

- describe the specific terminologies and objectives of utilizing different imaging modalities in clinical practice.
- infer the intensity and filtering operations on medical image datasets.

- summarize the segmentation and multimodal image registration techniques used for clinical applications.
- analyze the application of imaging techniques like transformations and rendering..
- explain the techniques and concepts of image registration and reconstruction.
- predict the issues in medical image archiving, retrieval and communication and apply the techniques to real world problems.

Unit I - Basics of medical image sources: Radiology-Electromagnetic spectrum-Attenuation and imaging - CT - MRI - Ultrasound- Nuclear medicine and molecular imaging-Other imaging techniques- Radiation protection and dosimeter- Image representation-Pixels and voxels-Gray scale and color representation- Image file formats-DICOM-Other formats-Image quality and Signal-noise ratio.
Unit II - Operations in intensity space: Intensity transform function and dynamic range-Windowing- Histograms and Histogram operations-Dithering and depth- Filtering and transformation-Filtering operation- Fourier Transform-Other transforms- Segmentation -ROI definition and centroids- Thresholding- Region Growing- Segmentation methods- Morphological operations-Evaluation of segmentation results
Unit III - Spatial transforms: Discretization-Resolution and Artifacts-Interpolation and Volume regularization-Translation and Rotation- Reformatting-Tracking and Image guided therapy- Rendering and Surface models-Visualization-Orthogonal and Perspective projection and the viewpoint-Ray casting- Surface based rendering
Unit IV - Image registration: Fusing information- Registration paradigms- Merit functions- Optimization strategies-Camera calibration- Registration to physical space-Evaluation of registration results- CT reconstruction-Radon transform- Algebraic reconstruction-Filtered back propagation
Unit V - Image compression: Fundamentals and standards of compression and communication- Medical image archive, retrieval and communication- Quality evaluation for compressed medical images- Three dimensional image compression with wavelet transforms.

Reference books:

1. Wolfgang Birkfellner, Applied Medical Image Processing: A Basic Course, CRC Press, 2011, ISBN: 1439824452, 9781439824450
2. Isaac Bankman, Handbook of Medical Image Processing and Analysis, Second edition, Academic Press, 2008, ISBN: 008055914X, 9780080559148
3. Geoff Dougherty, Digital Image Processing for Medical Applications, Cambridge University Press, 2009, ISBN: 0521860857, 9780521860857
4. Geoff Dougherty, Medical Image Processing: Techniques and Applications, Springer, 2011, ISBN: 1441997792, 9781441997791
5. Paul Suetens, Fundamentals of Medical Imaging, Cambridge University Press, 2009, ISBN: 0521519152, 9780521519151

17CS3033 ARTIFICIAL INTELLIGENCE FOR GAMES

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the fundamentals of intelligent behavior and decision making in games.
- apply the relevant algorithms in path finding strategies.
- design games using artificial intelligence techniques based on the genre.

Course Outcomes:
The student will be able to

- recognize the importance of artificial intelligence in games.
- identify the different steering behaviors in movement of characters.
- choose the path finding techniques for designing games.
- examine decision making method for games.
- design the strategies for the games using game theory.
- select the appropriate design for artificial intelligence games genre.

Unit I - Introduction to Artificial Intelligence: Model of Game AI - Algorithms - Data Structures and Representations- Game AI: The Complexity Fallacy- The Kind of AI in Games- Speed and Memory- The AI Engine.
Unit II - Basics of Movement Algorithms: Kinematic Movement Algorithm - Steering behaviors- Combining Steering Behaviors- Jumping- Coordinated Movements- Movement in the Third Dimension.
Unit III - Pathfinding and decision making: Pathfinding Graph- Dijkstra- A*- Hierarchical Pathfinding- Continuous Time Pathfinding- Movement Planning- Decision trees- Goal-oriented behavior- Rule-based systems- Decision tree learning- Reinforcement learning.
Unit IV - Strategies Board games: Game Theory- Min maxing- Transposition Tables and Memory- Memory-Enhanced Test Algorithms
Unit V - Designing Game AI: The Design- Shooters and Driving- Real Time strategy-Sports- Turn Based strategy Games- AI Based Game Genres- Teaching Characters- Flocking and Herding Games.

Reference Books:

1. Ian Millington, John Funge, Artificial intelligence for Games, Second edition, Morgan Kaufmann Publishers, CRC Press, 2012, ISBN: 978-0-12-374731-0 .
2. Stuart Jonathan Russell, Peter Norvig Russell,Artificial Intelligence - A Modern Approach, Second Edition, Prentice Hall, 2010, ISBN: 9780136042594.
3. Elaine Rich, Kevin Knight,Artificial Intelligence, Tata McGraw-Hill, 2004. ISBN: 9780070087705.
4. Dan W Patterson, Introduction to AI and Expert Systems, Prentice Hall, 2001. ISBN:81-203-0777-1.
5. John B. Ahlquist, Jeannie Novak, Game Development Essentials: Game Artificial Intelligence,Thomson-Delmar Learning, 2008, ISBN: 9781418038571.
6. David M. Bourg, Glenn Seemann, AI for Game Developers, O'Reilly Series, 2004, ISBN:9780596005559.
7. Richard Rouse, Game Design: Theory and Practice, Second Edition, Jones and Bartlett Learning, 2010, ISBN: 9781449633455.

17CS3034 BIG DATA AND GRAPH ANALYTICS

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the big data characteristics and its applications.
- use graph query language for analyzing graph data.
- choose appropriate graph mining algorithms for solving the real time problems .

Course Outcomes:
The student will be able to

- describe the big data concepts, sources, phases and characteristics
- identify various big data applications where graph analytics can be applied
- apply graph mining algorithms in graph applications to mine useful data
- analyze various graph indexing methods available for graph data analytics and use the appropriate one .
- categorize exact and inexact graph matching techniques.
- select appropriate clustering and classification algorithms suitable for developing graph applications.

Unit I - Basics of Big Data: Introduction - Characteristics - Sources - Phases of Big Data Analytics –Applications – Architecture Components - The Cloud and Big Data - Predictive Analytics - Crowd sourcing Analytics - Open Source Technology for Big Data Analytics.
Unit II - Graph Data Management: Introduction - Graph data Management Algorithms - Graph Mining Algorithms - Graph Applications
Unit III - Query Language and Indexing for Graph Databases: Introduction - Operations on Graph Structures - Graph Query Language - Implementation of Selection Operator - Feature based Graph Index - Structure Similarity Search.
Unit IV - Reachability Queries, Exact and Inexact Graph Matching: Traversal Approaches - Dual Labeling - Tree Cover - Chain Cover - Path Tree Cover - 2-Hop Cover - 3-Hop Cover - Distance Aware 2-Hop Cover - Graph Pattern Matching - Basic Notations - Exact Graph Matching - Inexact Graph Matching.

Unit V - Graph Clustering and Classification Algorithms: Introduction - Node Clustering Algorithms - Clustering Graphs as Objects - Applications –Graph Kernels - Graph Boosting - Applications of Graph Classification - Label Propagation.

Reference Books:

1. Dr.Aravindsathi , Big data analytics, IBM Corporation (2012) ISBN - 978 - 1 - 58347 - 380 - 1.
2. Charu C Aggarwal ,Haixun Wang , Managing and mining graph data, Springer (2010) ISBN - 978 - 1 - 4419 - 6044 - 3.
3. Michael Minelli , Michele Chambers, AmbigaDhiraj, Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses, Wiley CIO Series, (2013) ISBN: 978-1-118-14760-3.
4. Thomas A. Runkler , Data Analytics - models and algorithms for Intelligent data analysis Springer (2012) ISBN - 978 - 3 - 8348 - 2589 - 6.
5. Diane J. Cook, Lawrence B. Holder , Mining Graph Data, John Wiley and Sons (2007) ISBN - 978 - 0 - 471 - 73190 - 0.
6. Jay Liebowitz, Big Data and Business Analytics, CRC Press, Taylor and Francis Group (2013), Page 4.83*Computer Science and Technology*, ISBN- 978-1-4822-1851-0.
7. Paul Zikopoulos, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, McGraw Hill Publishers, (2011), ISBN - 978-0-07-179054-3

17CS3035 CLOUD COMPUTING

Credits: 3:0:0

Course Objectives:

Enable the student to

- provide an insight into the evolution of Cloud Computing.
- impart basic knowledge on Architecture of Cloud Computing.
- understand security issues in Cloud Computing implementations

Course Outcomes:

The student will be able to

- select appropriate design standards for cloud.
- classify the various cloud architectures and models.
- apply the security threats pertaining to cloud.
- analyze various existing cloud applications.
- create application execution models on cloud.
- choose standards like Ajax, XML, JSON, LAMP, LAPP for application developers.

Unit I - Introduction: The Emergence of Cloud Computing - Cloud based service offerings - Grid Computing Vs Cloud Computing - Key characteristics - Challenges for the cloud- Hardware and software Evolution - Server Virtualization - Services delivered over Cloud - Cloud computing infrastructure models.

Unit II - Architectural layers of Cloud computing: Cloud application programming interfaces-CPU virtualization-storage virtualization-Network virtualization -Case Study- Amazon EC2, S3, DB, Queues, Cloud Front .

Unit III - Security in the cloud: Security Issues In Cloud Computing-Cloud Security Challenges -Security Management - security governance -risk management - risk assessment - security monitoring and incident response - Security architecture design - Vulnerability Assessment- password assurance testing - security images - data privacy -Software as a Security .

Unit IV - Common standards in cloud computing-Distributed Management Task Force: Standards for Application Developers - Standards for Messaging - Standards for Security - Role of Virtualization in the Cloud .

Unit V - Cloud Computing Applications: YouTube- YouTube data API, Zimbra- Facebook- Zoho –MapReduce-Google paper -Big Tables –GFS - HDFS -Hadoop Framework.

Reference Books:

1. Cloud Computing - Implementation, Management and Security, John W. Rittinghouse, James F. Ransome, CRC Press, 2010.

2. Tom White, Hadoop the Definite Guide, O'REILLY, 2009
3. Judith Hurich, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley Publication Inc., 2010.
4. George Reese, Cloud Application Architectures, O'REILLY, 2009.
5. Tim Mather, Subra Kumarasamy, Shahed Latif, Cloud Security and Privacy, O'REILLY, 2009.
6. Introduction to Cloud Computing Architecture, White paper, SUN, Microsystems, 1st edition, June 2009.
7. Cloud Computing Specialist Certification kit.

17CS3036 COMPUTER GRAPHICS AND APPLICATIONS

Credits: 3:0:0

Course Objectives:

Enable the students to

- understand the foundations of computer graphics, math basis, light and colour.
- implement key components of the rendering pipeline, especially visibility, viewing, and shading.
- provide knowledge about modeling of characters, techniques about 3D computer animation and rendering.

Course Outcomes:

The student will be able to

- outline the importance of computer graphics, different graphics systems and applications of computer graphics.
- distinguish between 2D and 3D geometric transformations on graphics objects and their application in composite form.
- apply clipping and projections algorithm to display 3D scene on 2D screen.
- analyze the preproduction issues, modeling and rendering to process 3D computer animation.
- summarize the principles of 3D computer animation and its applications.
- compare the efficiency of various rendering algorithms.

Unit I - Video Display Devices: Raster Scan Systems - Line Drawing Algorithms - Parallel Line Algorithms - Setting Frame Buffer Values - Circle Generating Algorithms - Ellipse Generating Algorithms - other Curves - Parallel curve Algorithms - Pixel addressing and object Geometry - Fill area Primitives - Polygon Fill Areas - Attributes of Graphics Primitives: Line Attributes - Curve attributes - Fill area Attributes - General Scan Line Polygon Fill Algorithms - Scan Line Fill of Convex Polygons - Scan Line Fill for Regions with Curved Boundaries.

Unit II - Geometric Transformations: Basic Two Dimensional Geometric Transformations - Matrix Representations and Homogeneous Coordinates - Inverse transformations - Two dimensional Composite Transformations - Other Two Dimensional Transformations - Raster Methods for Geometric Transformations - Raster Transformations - Transformations Between Two Dimensional Coordinate Systems - Geometric Transformations in Three Dimensional space - Three dimensional Translations - Three Dimensional Rotation - Three Dimensional Scaling - Composite Three Dimensional Transformations - Other Three Dimensional Transformations - Transformations Between Three Dimensional Coordinate Systems - Affine Transformations - Geometric Transformation Functions - The Two Dimensional Viewing Pipeline - The Clipping Window - Normalization and Viewport - Clipping Algorithms - Two Dimensional Point Clipping - Two dimensional Line Clipping - Polygon Fill Area Clipping - Curve Clipping - Text Clipping.

Unit III - Preproduction: Storyboarding-Character and Model Design-Sound Design - Technical Tests-Production Scheduling Modeling-Polygon Modeling-Splines and Patches-Coordinate Systems-Viewing Windows-Geometric Primitives-Transformations-Common Modeling Techniques-Hierarchies-Booleans and Trims-Basic Deformations.

Unit IV - Modeling surface characteristics: Camera-Lights-Surface Characteristics-Shading Algorithms-Rendering Algorithms-Background Images-Surface Texture Mapping-Solid Texture Mapping-Final Rendering.

Unit V - Advanced Rendering: Introduction-Atmospheric Effects-Fractals-Lighting Subtleties-Advanced Texturing-Texturing Polygons-Background Shaders-Non-Photorealistic Rendering-Reflection Maps and Environment Procedures-More Rendering Algorithms-Rendering for Output.

Reference Books:

1. Donald Hearn, M.Pauline Baker, Warren Carithers, Computer Graphics with OpenGL, Pearson Education, fourth Edition, 2013, 1292024259, 9781292024257

2. Michael O'Rourke, Principles of Three-Dimensional Computer Animation, Third Edition, W.W.Norton and Company Ltd., 2003, ISBN: 0-393-73083-2.
3. F.S.Hill JR, Computer graphics using Open GL, Second Edition, Prentice Hall, 2007, ISBN: 0131362623.
4. John Vince, Essential Computer Animation, Springer-Verlag, 2000, ISBN: 1-85233-141-0.
5. Marcia Kuperberg, A Guide to Computer Animation, Focal Press, 2012, ISBN: 1136134859.

17CS3037 COMPUTER VISION

Credits: 3:0:0

Course Objectives:

Enable the student to

- describe the concepts in computer Vision.
- apply Knowledge on basic geometry, physics of imaging and probabilistic techniques.
- compare the linear filters and different views of computer vision.

Course Outcomes:

Students will be able to

- identify the Image Formation, Camera models and Parameters, Multiple View Geometry and Segmentation.
- describe the image models, radiometry and segmentation schemes used for clustering.
- apply Various Filters in practice.
- differentiate two, three and more view image models.
- construct image analysis models for real time applications.
- summarize the cameras, colours, filters, views and segmentation schemes.

Unit I - Image formation and image model: Cameras: Pinhole Cameras-Cameras with Lenses, The Human Eye, Geometric Camera Models: Elements of Analytical Euclidean Geometry Camera Parameters and the Perspective Projection, Affine Cameras and Affine Projection Equations, Geometric Camera Calibration: Least Squares Parameter Estimation, A Linear Approach to Camera Calibration, Taking Radial Distortion into Account.

Unit II - Radiometry measuring light: Light in space, Light at Surfaces ,Important Special Cases, Sources, Shadows and Shading: Qualitative Radiometry Sources and their effects, Local Shading Models, Color: The Physics of Color, Human Color Perception, Representing Color, A Model For Image Color, Surface Color from Image Color.

Unit III - Linear filters: Linear Filters and Convolution, Shift Invariant Linear System, Spatial Frequency and Fourier Transforms, Sampling and Aliasing, Filters as Templates, Technique Normalizes Co-relation and Finding Pattern, Edge Detection: Noise, Estimating Derivatives, Detecting Edges, Texture: Representing Texture, Analysis Using Oriented Pyramids, Application: Synthesizing Textures for Rendering, Shape From Texture.

Unit IV - The Geometry of multiple views: Two Views, Three Views, More Views, Stereopsis: Reconstruction, Human Stereopsis, Binocular Fusion, sing More Camera, Affine Structure from Motion: Elements of Affine Geometry, Affine Structure and Motion from Two Images, Affine Structure and Motion from Multiple Images, From Affine to Euclidean Images, Affine Motion Segmentation, Projective Structure from Motion: Elements Of Projective Geometry, Projective Structure and Motion from Binocular Correspondences, Projective Motion Estimation from Multi-linear Constraints.

Unit V - Segmentation by clustering: Human Vision: Grouping and Gestalt, Applications: short Boundary detection and Background subtraction, Image Segmentation by Clustering Pixels, Segmentation By Graph-Theoretic Clustering, Segmentation By Fitting a Model: The Hough Transform, Fitting Lines, fitting Curves, Segmentation and Fitting Using Probabilistic Methods: Missing Data Problems, Fitting and Segmentation

Reference Books:

1. David A.Forsyth, Jean Ponce, Computer Vision A Modern Approach, Second edition, Prentice Hall, 2003. ISBN-81-203-2372-6
2. Linda G. Shapiro, George C. Stockman, Computer Vision, Published by Prentice Hall, 2001. ISBN 0130307963, 9780130307965
3. Dana H. Ballard, Christopher M. Brown, Computer Vision, 2003. Prentice Hall, ISBN:13:9780131653160 , ISBN: 0131653164

17CS3038 CYBER FORENSICS

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the importance of cyber forensics and its application to real time scenarios
- develop knowledge on the legal issues in performing digital forensic
- anticipate security issues in outsourcing

Course Outcomes:

The student will be able to

- identify the effect of cybercrime in forensic computing
- infer digital forensic evidences and investigate the contents
- choose and apply current computer forensics tools.
- analyze the nature of cyber terrorism and its effects
- devise basic computer and network forensic analysis
- summarize the technical and legal aspects related to cyber crime

Unit I - Introduction: History and evolution- Definition and nature- Forensic Computing: Collection- Investigation and examination of digital evidence - Forensics Investigation- Collection and Examination & Authentication- Response - Cyber terrorism.

Unit II - Crime Related to Unauthorized Access: Hacking - Types of hackers - Examples of hackers- The techniques of hacking- Reasons of hacking- Prevention of hacking- Benefits of hacking- Cybercrimes in financial activities- Cyber terrorism -Electronic-Surveillance.

Unit III - Mobile and Wireless Technology: New playgrounds for cyber criminals - The computer and Internet security - Functions related computer and internet security- Security threat- suggestions for security- Economic Aspects of Computer and Internet security- Internet security and Children- Security Standards for Information Security- Future trends in Security- Blended Attacks- The Future of Wireless.

Unit IV - Forensics Investigation: Response- Computer forensics and the law- Cybercrime examples- Forensic evidence- Forensics casework- Preserving the integrity of the crime scene- Investigating incident-Response actions- Forensics analysis investigative actions- Computer forensic tools.

Unit V - Security Issues with Outsourcing: The nondisclosure agreement - Myths about outsourcing security - Security Service level agreements- Developing SLA- Components of an SLA- Adding security to the SLA equation - Future trends in security.

Reference Books:

1. R. K. Chaubey, An Introduction to cyber crime and cyber law, Kamal Law House, second edition 2014.
2. John W. Rittinghouse, William M. Hancock, Cybersecurity Operations Handbook, ISBN-13: 978-1555583064, 2005.
3. John R. Vacca, Computer forensics: Computer Crime Scene Investigation, 2nd Edition, Charles River Media, Inc. Boston, 2005, ISBN-13: 978-1584503897.
4. Nina Godbole, Sunit Belapure, Cyber security: understanding cyber crimes, computer forensics and legal perspectives, Wiley India Pvt. Ltd., 2011, ISBN-13: 978-8126521791.
5. Raghu Santanam, M. Sethumadhavan, Cyber Security, Cyber Crime and Cyber Forensics: Applications and Perspectives, Idea Group Inc (IGI), 2011, ISBN: 9781609601256

17CS3039 DATA MINING LAB

Credit: 0:0:2

Co –requisite: 17CS3031 Advanced Data Mining

Course Objectives:

Enable the student to

- gain hands-on experience in data mining tools
- get an insight into different aspects of data mining techniques like data pre-processing, data selection, classification, clustering and association

Course Outcomes:

The student will be able to

- select the appropriate data mining algorithms for solving practical problems
- identify the data preprocessing techniques for different types of data
- apply the statistical techniques to analyze the results
- analyze and choose the appropriate data mining techniques for real world problems
- develop a model for the given dataset using the machine learning algorithms
- predict the future occurrence of events based on the historical data

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

17CS3040 DATA WAREHOUSE

Credits: 3:0:0

Course Objectives:

Enable student to

- recognize different methods for handling unstructured data in a data warehouse.
- acquire the techniques to store the data across multiple storage media.
- discover advanced topics, including data monitoring and testing.

Course Outcomes:

The student will be able to

- define techniques to store data in storage media.
- identify methods for handling data in a data warehouse.
- relate database management principles with distributed data warehouse environment.
- point out the necessity of data migration.
- explain the web tools for large date warehouse management.
- select the model for data warehouse design.

Unit I - Introduction and Design: Evolution of Decision Support Systems - The Data Warehouse Environment - The Data Warehouse and Design.
Unit II - Granularity, Technology and Distributed Data Warehouse: Granularity in the Data Warehouse - The Data Warehouse and Technology - The Distributed Data Warehouse**.**
Unit III - Data Migration: Executive Information Systems and The Data Warehouse - External Data and The Data Warehouse - Migration to the architectural Environment.
Unit IV - Data Warehouse and the Web: The Data Warehouse and the Web - Unstructured Data and The Data Warehouse - The Really Large Data Warehouse.
Unit V - Multidimensional Models: The Relational and the Multidimensional Models as a Basis for Database and design - Advanced Topics in the Data Warehouse.

Reference Books:

1. William H.Inmon, Building the Datawarehouse, Wiley Dreamtech (P) Ltd, Fourth Edition,Reprint 2010, ISBN:81-265-0645-8.
2. Claudia Imhoff ,Nicholas Galenno, Jonathan G.Geiger, Mastering data warehouse design, Wiley Publishing, First Edition, 2003,ISBN:81-265-0365-3.
3. PaulrajPonniah, Data Warehousing Fundamentals - A Comprehensive guide for IT Professionals, John Wiley and Sons, Second Edition, 2010, ISBN:978-0-470-46207-2.

17CS3041 DATABASE SECURITY

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand security issues pertaining to database servers.
- classify security problems existing in popular database systems.
- summarize various techniques to secure database.

Course Outcomes:

The student will be able to

- describe the vulnerabilities in the database systems.

- identify measures to protect data and database
- discover the various security attacks pertaining to database systems.
- infer techniques to limit the attack consequences
- design secure database systems in their network
- relate and audit a customer's network for database security problems.

Unit I - Introduction for Database Security, Oracle: Oracle architecture- Attacking Oracle- Attacking the authentication process - Moving Further into the Network- Securing Oracle.
Unit II - IBM DB2 Universal Database: DB2 Discovery- Attack- Defense- Attacking DB2-Securing DB2.
Unit III - Informix: Information Architecture –Informix Discovery- Attack- Defense- Securing Informix.
Unit IV - Sybase ASE: Architecture- Sybase Discovery- Attack- and Defense- Moving further into the network- Securing Sybase.
Unit V - MySQL: Architecture- Discovery- attack and Defense- MySQL Moving further into network- Securing MySQL-SQL server Architecture- Exploitation- SQL Attack- SQL Defense- Securing SQL Server.

Reference Books:

1. David Litchfield, John Heasman, Defending Database Servers-The Database Hacker's Handbook, Wiley Dreamtech India (P) Ltd, 2005. ISBN: 81-265-0615-6.
2. Ron Ben Natan, Implementing Database Security and Auditing, Elsevier, 2005. ISBN: 81-312- 0134-1.
3. Ramez Elmasri, Navathe, "Fundamentals of Database System", Sixth Edition, 2011. ISBN: 10-0-136-08620-9,ISBN: 978-0-135-08620-8.
4. David Litchfield The Oracle Hacker's Handbook: Hacking and Defending Oracle,Wiley, First Edition Year 2007 ISBN-13: 978-0470080221

17CS3042 ELEMENTS OF MULTIMEDIA SYSTEMS

Credits: 3:0:0

Course Objectives:
Enable the student to
- acquire the basic components of multimedia
- recognize the fundamentals of media components such as audio, video and images
- learn and understand the need of data compression
- comprehend various compression methods and colour schemes.
- illustrate the fundamentals of storage mechanisms in multimedia

Course Outcomes:
The student will be able to
- describe the basic elements of multimedia.
- identify the methods to represent multimedia data through computer system.
- illustrate various multimedia compression standards.
- analyze the types of data compression methods for multimedia data.
- relate colour schemes in multimedia.
- compare various storage medium and its characteristics.

Unit I - Introduction to multimedia and audio technology: Interdisciplinary aspects of Multimedia-Media characteristics-Media Compression-Optical storage-Content Processing-Media and Data Streams: The term "Multimedia" –The term "Media" –Key properties of a multimedia system - Characterizing Data Streams –Audio Technology: What is Sound-Audio representation on computers-Music and the MIDI Standard - Speech Signals-Speech Output - Speech Input-Speech transmission.
Unit II - Graphics and images: Introduction –Capturing graphics and Images - Computer assisted Graphics and Image Processing - Reconstructing Images - graphics and Image Output Options - Video Technology: Basics - Television Systems - Digitization of video signals - Digital television –Computer Based Animation: Basic Concepts - Specification of Animations - Methods of controlling Animation - Display of animation - Transmission of Animation - Virtual reality modelling language(VRML).
Unit III - Graphics and image data representations: Graphics/Image Data Types - Popular File Formats-Further Exploration-Colour in Image and video: Colour Science - Colour Models in Images-Colour Models In video.

Unit IV - Data compression: Storage space - Coding Requirements - Source, Entropy, and Hybrid Coding - Basic Compression Techniques - JPEG - H.261 and H.263-MPEG - Fractal Compression-Wavelet Based Coding-The JPEG2000 Standard.

Unit V - Optical storage media: History of optical storage - Basic Technology - Video Discs and other WORMs - Compact disc digital audio - Compact Disc read only memory-CD-ROM Extended Architecture-Further CD-ROM Based Developments-Compact Disc recordable-Compact Disc Magneto-Optical-Compact Disc Read/Write-Digital Versatile Disc-Closing Observations, Content Analysis: Simple vs Complex features- Analysis Of Individual Images- Analysis Of Image Sequences-Audio Analysis-Applications.

Reference Books:

1. Ralf Steinmetz, Klara Nahrstedt, Multimedia Fundamentals, Pearson Education, Second Edition, 2004. ISBN: 978-81-317-0976-4.
2. Andreas Holzinger, Multimedia Basics, Volume 1, Firewall Media publisher, 2009, ISBN: 8170082439, 9788170082439
3. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Pearson Education, 2004. ISBN 81-2970438-2.
4. Jens Ohm, Multimedia Communication Technology, Springer-Verlag, 2004. ISBN: 3-540- 01249-4.
5. Daniel Cunliffe, Geoff Elliott, Multimedia Computing, Lexden Publishing Limited, 2005, ISBN: 1904995055, 9781904995050

17CS3043 EVOLUTIONARY COMPUTING

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the basic concepts of evolutionary methods in problem solving
- apply evolutionary strategies for multi-modal and spatial distribution problems
- solve combinatorial optimization problems using various approaches of evolutionary computation

Course Outcomes:

The student will be able to

- describe the evolutionary algorithms and its components
- identify the different learning classifier systems.
- employ genetic programming to solve real world problems
- analyze the evolutionary algorithms using different performance metrics.
- design efficient algorithms for multi modal problems
- choose appropriate performance measures for evaluating the evolutionary algorithms.

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Unit I - Introduction: The inspiration from biology- EC metaphor-history-why evolutionary computing- what is EA-components of EA- example application- working of an EA- EC and global optimization- Genetic Algorithms-Evolution Strategies.

Unit II - GA, GP and classifiers: Genetic algorithm-example-recombination- parent selection- survivor selection-example application-genetic programming- problems involving physical environment- example-symbolic regression- learning classifiers system-back ground-ZCS-XCS-extensions-example.

Unit III - Parameter control and Multi- modal problems: Introduction- examples of changing parameter-classification of control techniques-examples of varying EA parameters- Multi modal problems and spatial distribution- Implicit measures-explicitly diversity maintenance-multi objective GA-example applications.

Unit IV - Hybridization, Theory and Constraint handling: Hybridization with Other Techniques-motivation-introduction to local search-structure of memtic algorithms-design issues of mimetic Algorithms- example application- Theory- competing hyperplanes in binary spaces- dynamical systems- Markov chain Analysis-statistical mechanics approached- reductionist approaches- analyzing EAs in continuous search space- no free lunch theorem-constraint handling.

Unit V - Special Forms and Working with Evolutionary Algorithms: Special forms of EA- co evolution-interactive evolution-non stationary function optimization- working with EA-performance measures-test problems for experimental comparisons- example application.

Reference Books:

1. E. Eiben and J. E. Smith, Introduction to Evolutionary Computing, Springer - Natural Computing Series, 2 nd edition,2015. ISBN: 978-3662448731.
2. N. Nedjah, E. Alba, L. de. Macedo Mourelle, Parallel Evolution Computation, Springer Natural Computing Series, 2006. ISBN-10: 3-540-32837-8.
3. Kenneth A. De Jong, Evolutionary Computation: A Unified Approach, MIT Press, 2006. ISBN-10:0-262-04194-4
4. Riccardo Poli, William B. Langdon and Nicholas Freitag McPhee, A Field Guide to Genetic Programming, Springer, March 2008. ISBN: 978-1-4092-0073-4
5. Kenneth A. De Jong , Evolutionary Computation: A Unified Approach, Mit Press, 2006, ISBN 0262041944

17CS3044 GRID COMPUTING

Credits: 3:0:0

Course Objectives:

Enable the student to

- identify the concepts of Grid Computing and the emerging technology standards on Grid infrastructure..
- classify various grid scheduling algorithms.
- compare various prominent toolkits and middleware solutions that impact the Grid adoption.

Course Outcomes:

The student will be able to

- recognize the behavior of grid computing with other computing environments.
- classify the information services provided by Grid computing.
- demonstrate the working principles of grid applications and grid components.
- analyze the security measures and authentication measures can be achieved in grid computing.
- summarize the scheduling algorithms in grid meta scheduler.
- compare and contrast various middleware services provided by Grid environment.

Unit I - Introduction to Grid Computing: Grid Vs other Distributed Systems - Motivation for using Grid - Autonomic computing- Semantic Grids - Grid Architecture - Few Standards of Grid.

Unit II - Data Management: Introduction - Data Management - Data management services in Grid computing environment.

Unit III - Grid Scheduling and Information Services: Introduction, Job Mapping and Scheduling - Service Monitoring and Discovery - Grid Workflow - Fault Tolerance in Grid - Meta Schedulers.

Unit IV - Security in Grid Computing: Trust and Security in a Grid Environment, Grid Security Infrastructure - Authentication - Authorization - Confidentiality - Delegation - Elementary Services - Advanced Services.

Unit V - Grid Middleware: Introduction, Types of Grid Middleware - OGSA - OGSI - Architectural Overview of GRID projects - GRID Enabling Applications.

Reference Books:

1. Frederic Magoules, Jie Pan, Kiat-An Tan, Abhinit Kumar, Introduction to Grid Computing, CRC Press, 2009. ISBN 978-1-4200-7406-2.
2. Barry Wilkinson, Grid Computing Techniques and Application, CRC Press, 2010. ISBN 978-1-4200-6953-2.
3. Frederic Magoules, Fundamentals of Grid Computing, CRC Press, 2010. ISBN: 978-1-4398-0367-7.

17CS3045 INFORMATION SECURITY AUDIT AND ASSURANCE

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the basic concepts of information security and audits.
- classify new approaches and standards to solve a wide variety of research-oriented problem.
- Evaluate the quality of audit and assurance system.

Course Outcomes:
The student will be able to

- identify the best practices which utilize the means and methods of disguising information in order to protect confidentiality and integrity.
- describe the foundation of IT audit and control
- practice IT planning and quality management for projects
- analyze the auditing IT acquisition and implementation
- explain the vulnerability of an information audit system and establish a plan for risk management.
- summarize the legal rules and its impact on information technology

Unit I - Information Technology Environment: Controls and Audit - Audit and Review- It's Role in Information Technology - The Audit Process in an Information Technology Environment.
Unit II - Auditing IT Planning and Organization: IT strategy and standards - Planning and Controlling - Project Management - Quality Management.
Unit III - Auditing IT Acquisition and Implementation: Software Acquisition - System implementation - Application Risk and Controls - Change management.
Unit IV - Auditing IT Operation from Standalone to Global: Complexities and Control Issues - Operational Control Issues –Assessing Risk in IT Operations - Audit methods and techniques for operations -Emerging issues in IT Audit.
Unit V - The legal environment and its impact on information technology: From IT Crime Law to IT Contract Law to Netlaw - Security and Privacy of Information Technology– IT Auditing.

Reference Books:

1. Frederick Gallegos, Sandra Senft, Daniel P. Mason, Carol Gonzales, Information Technology Control and Audit, Auerbach Publications, Fourth Edition, 2012. ISBN-13: 9781439893203.
2. Nina Godbole, Information systems security: security management, metrics, frameworks and best practices, Wiley India Pvt Ltd, 2012. ISBN-13: 9788126516926.
3. JagdishPathak, Information Technology Auditing: an Evolving Agenda, Springer, 2005. ISBN-13: 9783540221555

17CS3046 INTERACTIVE GAME DESIGN

Credits: 3:0:0

Course Objectives:
Enable the student to

- understandthe concepts of designing a game and the role of a game designer.
- design a game using conceptualization, prototyping and playtesting.
- work as a game designer by understanding the team structures, stages of development.

Course Outcomes:
The student will be able to

- outline the role of game designer and game designing process.
- classify the formal and dramatic elements for designing a game.
- apply the conceptualization techniques and turn the ideas into game.
- analyse the prototyping models using various playtesting mechanisms.
- comply with the standards of game industries for developing team structures, team building and team communication.
- Estimate the cost of a game by preparing project plan and informative design documents.

Unit I - The role of the game Designer, the structure of games: Passion and Skills, A Play centric design process- Designing for innovation, Go fish versus Quake-Engaging the player, The sum of parts- Defining games.
Unit II - Working with formal elements and system dynamics: Players, Objectives, Procedures, Rules, Resources, Conflicts, Boundaries, Outcome. Dramatic elements: Challenge, Play, Premise, Character, Story. Worldbuilding. Games as Systems, System dynamics, Interacting with systems, Tuning game systems.
Unit III - Conceptualization, prototyping and digital prototyping: Ideas, Brain Storming skills, Alternate methods, Editing and refining, Turning idea into game. Methods of prototyping, Prototyping original game idea.

Types of digital prototype, Designing control schemes, Selecting viewpoints, Effective interface design, Prototyping tools.

Unit IV - Play testing, functionality, completeness, balance, fun and accessibility: Play testing and interactive design, Play testing session. Methods, The play matrix, Usability techniques, Test control situation, Is your game functional, internally complete and balanced? Techniques for balancing your game. Improving player choices, Fun killers, Beyond fun, Is your game accessible?

Unit V - Team structure, stages and methods of development, communicating your designs: Developers team, Publishers team contribution to the design, Team communication. Stages, Using agile development, Agile project planning, Visualization, Flowcharts, Tables and spreadsheets, Concept art, Description, Formats for design documents, Contents, Design macros.

Reference Books:

1. Tracy Fullerton, Christopher Swain, Steven Haffman, Game Design Workshop: A Playcentric Approach to Creating Innovative Games, Third Edition, CRC Press, Taylor & Francis Group, 2014,ISBN: 13: 978-1-4822-1716-2
2. Jesse Schell, The Art of Game Design: A book of lenses, Second Edition, CRC Press, 2015, ISBN:9781466598645
3. Scott Rogers, Level Up!: The Guide to Great Video Game Design, Second Edition, John Wiley and Sons, 2014, ISBN: 978-1-118-87716-6
4. Richard Rouse, "Game Design: Theory and Practice", Second Edition, Jones and Bartlett Learning, 2010, ISBN: 9781449633455
5. Lewis Pulsipher, "Game Design: How to Create Video and Tabletop Games, Start to Finish", McFarland, 2012, ISBN: 0786491051, 9780786491056

17CS3047 INTERNETWORKING MULTIMEDIA

Credits: 3:0:0

Course Objectives:

Enable the student to

- identify the requirements that a distributed multimedia application may enforce on the communication network.
- apply and analyze the various coding and compression techniques suitable for multimedia application.
- compare all the important aspects that has significant impact on the enhancements to the basic Internet architecture and its associated protocols.

Course Outcomes:

Students will be able to

- identify internetworking principles and issues in multimedia technologies, difference between different network service model and to describe how multicasting on the Internet works.
- classify the loseless and lossy compression techniques that can be used to transmit the multimedia information.
- employ the suitable transport protocol and implement the multimedia data transfer through the internetwork.
- analyze the various session creation and maintenance protocols and to identify the suitable protocols for a real time application.
- generate an ideal multimedia conference model which is suitable for an application scenario.
- summarize the applications of the internetworking models in multimedia information transmission system.

Unit I - Introduction- A brief history of real time: Content and delivery-From letters and numbers to sound and vision-Analogue and digital-Protocols-Internet Service models-Multicast in the internet-Transport Protocols-Multimedia Sessions-Conference Membership and Reception feedback-Security-Application other than Audio and Video Network Service Models: Sharing and caring-Service schedules and Queues-Evolution of the internet service models-Resource reservation protocol (RSVP), Service classes and assurance-Detailed analysis of the integrated services-Host functions- Resource reservation protocol (RSVP)revisited-QoS routing-Futures-IP and ATM- Recent simplified approaches to service differentiation.

Unit II - Multicast, coding and compression: Host Functions -Routing and addressing Multicast routing-Multicast scoping-Reliable multicast transport- Calling down traffic on a Site Coding and Compression: System Components-Nature of the signal-lossless data compression Audio-Still image-Moving image-Multiplexing and synchronizing-performance-Processing requirements for video Compression.
Unit III - Transport protocols, session directories, advertisement and invitation protocols: Introduction-TCP adoption algorithms-MPEG systems-Transport and program streams-RTP-Synchronization-Reliable multicast transport Session Directories, Advertisement And Invitation Protocols: Session Description protocol (SDP)- Session announcement protocol (SAP)-Section initiation protocol (SIP) Conference Controls: ITU model H.320/TGCC-MMCC a Centralized Internet model-CCCP distributed Internet model-Using ISDN to do IP access to the Mbone.
Unit IV - Applications: Introduction-Shared applications in the Mbone: Design-Limitations of the data model-Usability Issues-Asynchronous events-Generalizing the models-Distributed virtual reality: General idea and problems-Virtual reality operations, user views and network considerations application model-Distributed virtual reality multicast protocol (DVRMP).
Unit V - Media-on demand, Security and Policy in multicast multimedia: Recording and playing back Mbone sessions- Recording -Remote control of playback Security And Policy In Multicast Multimedia: Introduction-Roadmap-A brief introduction to cryptographic technology-Network-level solutions-media encryption-key distribution.

Reference Books:

1. Jon Crowcroft, Mark Handley, Ian Wakeman, Internetworking Multimedia, Publisher: Morgan Kaufmann; Illustrated Edition, 1999, ISBN: 1558605843.
2. B.O. Szuprowicz, Multimedia Networking, McGraw Hill, NewYork. 1995. ISBN-13: 978- 0070631083
3. Tay Vaughan, Multimedia Making it work, Sixth Edition, Tata McGraw-Hill, 2003. ISBN- 13: 978-0072230000.

17CS3048 IP TELEPHONY

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the basics of Voice over IP (VoIP) and its supporting protocols
- analyze the interconnection practices in PSTN
- adapt the available VoIP security practices

Course Outcomes:
The student will be able to

- describe the basic operation and components involved in an IP telephony call
- distinguish the technologies used in Voice over IP and PSTN technologies
- employ technologies to configure and connect a basic Voice over IP network into the PSTN
- examine the VoIP interconnect services.
- categorize the Quality of service metrics in a VoIP Network.
- evaluate the performance and characteristics of VoIP.

Unit I - Introduction to VoIP Protocol: Global IP Telephony Reachability - Traffic Analysis VoIP versus PSTN /Mobile - Fixed VoIP - Mobile VoIP - IP Multimedia Subsystem - Telecoms and Internet converged Services - Protocols for Advanced Networks (TISPAN) Overview.
Unit II - Interconnection Practices: Interconnection practices in PSTN - Roaming practices in Mobile Networks - Interconnection practices in GPRS network - VoIP service provider - IP Network Provider and Service Provider - IP Telephony Administrative Domain (ITAD) - IP Telephony Administrative Domain and Autonomous Systems.
Unit III - VoIP interconnection models: Analysis - Nodes - Border controllers - Deployment context - Technical features - Interconnection scenarios - Implementation Models - VoIP Security Best Practices.
Unit IV - Beyond VoIP: Why beyond VoIP protocols - Speech coding techniques - Advanced voice coder algorithms - Waveform coders ADPCM ITU-T G.726 - Hybrids and analysis by synthesis (ABS) speech coders - Codebook excited linear predictive (CELP) coders - Quality of speech coders - Voice quality.

Unit V - Quality of service: Describing a data stream - Queuing techniques for QoS - Signaling QoS requirements - Improving QoS in the best effort class - Issues with slow links.

Reference Books:

1. Mohamed Boucadair, Isabel Borges, Pedro Miguel Neves, Olafur Pall Einarsson, IP Telephony Interconnection Reference: Challenges, Models, and Engineering, CRC Press, 2012, ISBN 1-46651-298-9
2. Olivier Hersent, Jean-Pierre Petit, David Gurle, Beyond VoIP Protocols: Understanding Voice Technology and Networking Techniques for IP Telephony, John Wiley and Sons, 2005, ISBN 0-47002-363-5
3. Kevin Brown, IP Telephony Unveiled, CISCO Press, 2004, ISBN 1-58720-075-9.
4. Ted Wallingford , Switching to VoIP, O'Reilly Media, Inc.,2005, ISBN 0-59600-868-6
5. James F. Ransome, John Rittinghouse ,VoIP Security, Digital Press, 2005, ISBN 0-08047-046-7
6. Stephanie Carhee, The Road to IP Telephony: How Cisco Systems Migrated from PBX to IP Telephony, Cisco Press,2004, ISBN 1-58720-088-0

17CS3049 KNOWLEDGE MANAGEMENT

Credits: 3:0:0

Course Objectives:

Enable the student to

- provide an insight about knowledge, knowledge management system life cycle and technical aspects of knowledge management.
- discuss about knowledge creation and knowledge capture.
- expose the students to ethical, legal and managerial issues in knowledge management.
- examine how tacit knowledge is codified and how the resulting knowledge base is implemented.

Course Outcomes:

The student will be able to

- define knowledge management systems life cycle and its components.
- explain the process of knowledge creation
- prepare tools and procedures to gather knowledge
- model learning methodologies
- summarize the testing process involved to achieve quality.
- assess the various modes of knowledge transfer

Unit I - Introduction: Definitions - Cognition and Knowledge Management - Data- Information and Knowledge - Types of Knowledge - Expert Knowledge - Human Thinking and Learning - Implications of Knowledge Management - Knowledge Management Systems Life Cycle.

Unit II - Knowledge Creation and Knowledge Architecture: Knowledge Capture - Evaluating the Expert - Developing a Relationship with Experts - Fuzzy Reasoning and the Quality of Knowledge Capture.

Unit III - Interview as a Tool: Guide to a Successful Interview - Rapid Prototyping in Interviews - Implications - Other Knowledge Capture Techniques - Knowledge Codification - Why Codify? Modes of Knowledge Conversion - How to Codify Knowledge? - Codification Tools and Procedures - Knowledge Developer's Skill Set - Implications.

Unit IV - Quality and Quality Assurance: Knowledge Testing - Approaches to Logical Testing and User Acceptance Testing - Managing the Testing Phase - KM System Deployment - Issues Related to Deployment - User Training and Deployment - Post Implementation Review and Implications.

Unit V - Knowledge Transfer and Transfer Methods: Role of the Internet in Knowledge Transfer - Implications - Knowledge Transfer in the E-World - Learning Concept - Data Visualization - Neural Networks as a Learning Model - Association Rules - Classification Tree - Implications - Data Mining and Knowing the Unknown - Knowledge Management Tools and Portals - Who Owns - Knowledge? Ethical and Legal Issues - Managing Knowledge Workers.

Reference Books:

1. Elias M. Awad and Hassan Ghaziri, Knowledge Management, Pearson Education India, 2008, ISBN 978-81317-140-34.
2. Irma Becerra-Fernandez and Rajiv Sabherwal, Knowledge Management: Systems and Processes, M.E. Sharpe Inc.,2010, ISBN: 978-0-7656-2351-5.

3. Shelda Debowski, Knowledge Management: A Strategic Management Perspective, John Wiley and Sons, Australia, 2007 ISBN 978-81-265-1450-2.
4. Kimiz Dalkir, Knowledge Management in Theory and Practice, Elsevier Inc. 2005, ISBN-13: 978-0262015080.
5. Stuart Barnes, Knowledge Management Systems: Theory and Practices, Thomson Learning, 2002, ISBN:1-86152-616-4.

17CS3050 MULTIMEDIA COMMUNICATION

Credits: 3:0:0

Course Objectives:

Enable the student to

- acquire knowledge on multimedia communication standards and compression techniques.
- grasp the Internet protocol standards.
- understand the standards for multimedia broadband and satellite communications.

Course Outcomes:

The student will be able to

- describe various multimedia data and its transmission characteristics.
- classify various network standard and identify the suitable standard for multimedia communication.
- illustrate the concepts based on multimedia compression techniques, Internet protocols.
- identify the errors in multimedia communication with suitable error detection and correction methodologies
- relate multimedia communication with broad band ATM Networks.
- describe the applications of multimedia in digital television networks.

Unit I - Multimedia communications and audio video compression: Introduction-Multimedia Networks - Multimedia Applications-Applications and networking terminology- Audio compression and Video Compression

Unit II - Standards and digital multimedia communications: Introduction - Reference Models-Standards relating to interpersonal communications-Standards relating to interactive applications over the Internet-Standards for entertainment applications. Digital communication basics: Transmission Media-Sources of signal impairment-Asynchronous Transmission-Synchronous Transmission-Error Detection methods

Unit III - The internet: IP datagrams-Fragmentation and reassembly-IP addresses-ARP and RARP- Routing algorithms-ICMP-QoS support-The PPP link layer protocol-IPv6-IPv6/IPv4 interoperability.

Unit IV - Broadband ATM networks and entertainment networks: Cell format and switching principles- Switch Architectures-Protocol architecture. Entertainment networks and high speed modems: Cable TV networks-Satellite television networks-Terrestrial television networks High-speed PSTN access technologies-Transport protocols: TCP/IP protocol suite-UDP-RTP and RTCP

Unit V - Multimedia communications across networks: Packet Audio/Video in the network Environment -Video transport across generic networks-Multimedia transport across ATM networks - Multimedia across IP networks - Multimedia across DSLs - Internet access Networks - Multimedia across wireless - Mobiles Networks - Broadcasting Networks - Digital Television infrastructure for interactive multimedia services

Reference Books:

1. Fred Halsall, Multimedia Communications, Pearson, Seventh Indian Reprint, 2005. ISBN: 81-7808-532-1.
2. K .R. Rao, Zaron S. Bojkovic, Dragorad A. Milocanovic, Multimedia Communication Systems, Prentice Hall India, 2006. ISBN: 0471656402, 9780471656401.
3. Steve Heath, Multimedia and Communication Technology, Second Edition, Focal Press, 2003. ISBN: 818147-145-8.
4. Kumar Krishna, Multimedia Communication, Pearson Education India, 2010. ISBN: 813173238X, 9788131732380.

17CS3051 MULTIMEDIA DATABASE

Credits: 3:0:0

Course Objectives:

Enable the student to

- realize the design, indexing and retrieval of centralized and distributed multimedia database.
- understand the contemporary trends in multimedia data management and mining used for electronic enterprise.
- comprehend the theoretical foundation of distributed multimedia database.

Course Outcomes:

The student will be able to

- recall various multimedia data types.
- discuss the concepts on distributed multimedia database.
- illustrate various audio, video indexing and retrieval techniques.
- select the text and document retrieval techniques.
- relate multimedia information retrieval with web search engines.
- describe the privacy and security consideration in multimedia information retrieval system

Unit I - Introduction to multimedia database: Multimedia Data Types and Formats - Multimedia Database Design Issues.

Unit II - Text document indexing and retrieval: - Indexing and Retrieval of Audio - Image Indexing and Retrieval.

Unit II - Video indexing and retrieval: Integrated Multimedia Indexing and Retrieval -. Techniques and Data Structures for Efficient Multimedia Similarity Search.

Unit IV - System support for distributed multimedia databases: Introduction - QoS Management - Design Goals of Multimedia Systems - Multimedia Data Storage Devices and Management - Multimedia Computer Architectures - Multimedia Operating Systems - Multimedia Networks - Multimedia Transport Protocols - Achieving Overall Synchronous Presentation.

Unit V - Measurement of multimedia information retrieval effectiveness: Products, Applications and New Developments - Multimedia for Web and E-Commerce - Multimedia for Collaboration, Knowledge Management and Training for the Web - Security and Privacy Considerations for Managing and Mining Multimedia Databases - Standards, Prototypes and Products for Multimedia Data Management and Mining.

Reference Books:

1. Guojun Lu, Multimedia Database Management Systems, Illustrated Edition, Artech House Publishers, 1999 (digitized 2012). ISBN: 0890063427, 9780890063422.
2. Bhavani M. Thuraisingham, Managing and Mining Multimedia Databases, First Edition, CRC Press, 2008. ISBN: 0849300371, 9780849300370
3. Lynne Dunckley, Multimedia Databases, First Edition, Addison-Wesley, 2008. ISBN:0201788993, 9780201788990.
4. ChabaneDjeraba, Multimedia Mining: A Highway to Intelligent Multimedia Documents, Springer, 2003, ISBN: 1402072473, 9781402072475
5. Kingsley C. Nwosu, Bhavani M. Thuraisingham, P. Bruce Berra, Multimedia Database Systems, First Edition, Springer, 1996. ISBN: 0792397126, 9780792397120.

17CS3052 MULTIMEDIA DESIGN STORAGE AND ANALYSIS

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the multimedia working systems by combining audio and video with text, image, graphics and animation.
- apply step-by-step approach to multimedia system design.
- develop multimedia standards, compression technologies as well as various storage technologies.
- summarize the fundamental concepts of content based information retrieval of images, Audio and video.

Course Outcomes:

Students will be able to

- identify various multimedia standards and compression technologies

- express the knowledge of integrated multimedia working systems
- demonstrate different realizations of multimedia tools and their usage
- understand the multimedia standards and the concepts of content based information retrieval
- explain various storage technologies
- compare different design components of a real world multimedia solution

Unit I - Multimedia Compression-Need for data compression-Image compression-Video and audio compression-Multimedia Data Interface Standards-Multimedia Databases- Compression schemes-Video, Image and audio compression.
Unit II - Storage and Retrieval-Magnetic Media Technology- Hierarchical storage management-Cache management for storage systems -Memory Systems-Multimedia Board Solutions-Distributed Object Models.
Unit III - Multimedia Application Design- Application classes-Types of multimedia Systems-Virtual reality design-Multimedia Components -Organizing Multimedia Databases- Design Issues- Application workflow Design Issues-Distributed application design issues.
Unit IV - Hypermedia messaging-Mobile Message- Hypermedia message components-Linking and Embedding-Creating hypermedia messages-Integrated multimedia message standards-Integrated Document Management-Fundamentals of content based image retrieval.
Unit V - Video analysis and summarization-Content based retrieval for digital audio and music- MPEG-7 standard- Object repositories for digital libraries-Information discovery on WWW-Cooperative Multimedia Information systems.

Reference Books:

1. Prabhat K. Andleigh and Kiran Thakrar , Multimedia Systems Design, Prentice Hall, 2008, ISBN -978- 81-203-2177-9.
2. David Dagan Feng, Wan-Chi Siu, Hong-Jiang Zhang, Multimedia Information Retrieval and Management Technological Fundamentals and Applications, Springer, 2003. ISBN: 978-3-540-00244-4.
3. Nigel Chapman and Jenny Chapman, Digital Multimedia , John Wiley and Sons Private Limited, 2001, ISBN: 0471983861.
4. William I. Grosky, Ramesh Jain, Rajiv Mehrotra, The Handbook of Multimedia Information Management, Prentice Hall, 1997. ISBN: 0132073250, 9780132073257
5. Ze-Nian Li. Mark S. Drew, Fundamentals of Multimedia, First Edition 2004, ISBN: 81-297-0-438-2.
6. Tay Vaughan, Multimedia Making it work, Sixth Edition, Tata McGraw-Hill, 2003. ISBN- 13: 978-0072230000.
7. John F. Koegel Buford, Multimedia Systems, Third Edition, 2000, ISBN: 8177588273.

17CS3053 NETWORK SECURITY

Credits: 3:0:0

Course Objectives:
Enable the student to
- explain the basic concepts in network security.
- introduce the fundamental techniques in implementing secure network communications.
- create an awareness in the malicious behavior of threats and attacks.

Course Outcomes:
The student will be able to
- describe the concepts related to applied cryptography, including authentication, intrusion detection, digital signatures, etc.
- paraphrase user authentication through Kerberos.
- choose the mechanisms to protect against the identified threats.
- analyze the requirements of security for real time applications such as for email and other web based applications.
- formulate new solutions for network and internet security.
- appraise different Information thefts and malicious software.

Unit I - Message & user authentication: Approaches to message authentication– overview of authentication systems - secure hash functions - Password based and address based authentication -Message authentication codes - Cryptographic Protocols - Public key cryptography principles, Digital signatures, passwords as keys, eavesdropping.
Unit II - Internet Security: Kerberos V1 - Kerberos V2 - Electronic mail security - Introduction - Pretty good privacy - S/MIME - Domain Keys Identified Mail–IP Security - IPSec - Modes of IPSec -Web security -Secure Socket Layer - Transport Layer Security.
Unit III - Network Management Security & Intrusion Detection: Network management security - Basic concepts of SNMP - SNMP v1 - SNMP v3 - intrusion detection: Intruders - Intrusion detection - Password Management.
Unit IV - Firewall design principles & Network Access Control: Need for firewalls - Firewall Characteristics - Types of firewall - Firewall Basing - Firewall Location and Configurations - Network Access Control -Extensible Authentication Protocol - IEEE 802.1X Port-Based Network Access Control.
Unit V - Malicious Software& Information Theft: Types of Malicious Software, Propagation - Infected Content - VirusesPropagation - Vulnerability Exploit - Worms, Propagation - Social Engineering - SPAM, Trojans - System Corruption, Attack Agent - Zombie, Bots -Key loggers, Phishing, Spyware– Backdoors, Rootkits - Countermeasures.

Reference Books:

1. William Stallings, Network Security Essentials Applications and Standards, 5th edition, Prentice Hall, 2013, ISBN-13: 978-0133370430.
2. William Stallings, Cryptography and network security, 6th edition, Pearson, 2013, ISBN-13: 978-0133354690
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, Network Security: PRIVATE Communication in a Public World, 2nd edition, reprint 2008, Prentice Hall, ISBN-13: 978-0130460196.
4. Jan L. Harrington, Network Security: A Practical Approach, Morgan Kaufmann Publishers, reprint 2006, ISBN-13: 978-0123116338. 14C

17CS3054 PARALLEL COMPUTING

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the every aspect of parallel computing and parallel algorithm.
- Compare and contrast both traditional computer science algorithms as well as scientific computing algorithms.
- evaluate MPI, Pthreads and Open MP, for writing portable parallel programs.

Course Outcomes:
The student will be able to

- identify different parallel architectures, inter-connect networks, programming models, and parallel algorithms.
- discuss the communication models in parallel algorithm
- illustrate traditional computer science algorithms as well as scientific computing algorithms.
- analyze proficiency in parallel algorithm design .
- design MPI, Pthreads and Open MP, the three most widely used standards for writing portable parallel programs.
- evaluate various sorting algorithms on parallel computers

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Unit I - Introduction to Parallel Computing: Motivating Parallelism - Scope of Parallel Computing. Parallel Programming Platforms-Trends in Microprocessor Architectures - Limitations of Memory System Performance-Dichotomy of Parallel Computing Platforms - Physical Organization of Parallel Platforms-Communication Costs in Parallel Machines - Routing Mechanisms for Interconnection Networks
Unit II - Principles of Parallel Algorithm Design: Preliminaries - Decomposition Techniques - Characteristics of Tasks and Interactions - Mapping Techniques for Load Balancing - Methods for Containing Interaction Overheads - Parallel Algorithm Models-Basic Communication Operations

Unit III - Programming Using the Message-Passing: Principles of Message-Passing Programming - The Building Blocks: Send and Receive Operations - MPI: the Message Passing Interface - Topologies and Embedding - Overlapping Communication with Computation. Collective Communication and Computation Operations - Groups and Communicators

Unit IV - Programming Shared Address Space: Thread Basics -Why Threads? The POSIX Thread API - Thread Basics: Creation and Termination - Synchronization Primitives in Pthreads - Controlling Thread and Synchronization Attributes - Thread Cancellation - Composite Synchronization Constructs - Tips for Designing Asynchronous Programs OpenMP: a Standard for Directive Based Parallel Programming.

Unit V - Sorting: Issues in Sorting on Parallel Computers - Sorting Networks - Bubble Sort and its Variants - Quick sort - Bucket and Sample Sort - Other Sorting Algorithms Graph Algorithms: Definitions and Representation - Minimum Spanning Tree: Prim's Algorithm - Single-Source Shortest Paths: Dijkstra's Algorithm - All-Pairs Shortest Paths- Transitive Closure- Connected Components - Algorithms for Sparse Graphs.

Reference Books:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, Second Edition, Reprint 2012, Pearson Education, ISBN-13: 9788131708071
2. Roman, Peter, Parallel Computing: Numerics, Applications, and Trends, 2010, ISBN-13: 9781849968416.
3. Michael J. Quinn, Parallel Computing: Theory and practice, Second edition, Reprint 2008, Tata McGraw - Hill Education, ISBN-13: 9780070495463.
4. Peter Arbenz, Wesley Petersen, W.P. Petersen, Introduction to Parallel Computing, 2008, Oxford, ISBN-13: 9780199560868

17CS3055 PATTERN RECOGNITION

Credits 3:0:0

Course Objectives:

Enable the students to

- understand the basics of patterns recognition systems, parameter and non parameter estimation techniques.
- apply the discrimination functions, stochastic and non-metric methods.
- develop the appropriate algorithm in recognizing various patterns.

Course Outcomess:

The Student will be able to

- recall the basic pattern recognition systems.
- predict the discrete features for pattern recognition using bayesian decision theory, maximum likelihood, and hidden markov models.
- estimate the network density and energy using non-parametric techniques.
- apply the linear discriminant functions in programming algorithms for different patterns.
- explainthe stochastic search to solve mathematically the real time pattern recognition problems.
- design independent algorithms using machine learning, unsupervised learning and clustering in pattern recognition.

Unit I - Introduction And Bayesian Decision Theory: Pattern Recognition Systems-Design cycle-Learning and adaptation- Bayesian Decision Theory- Maximum Likelihood Estimation-Bayesian estimation- Bayesian Parameter Estimation- Problems on dimensionality-Component Analysis and Discriminations- Hidden Markov models.

Unit II - Non Parametric Techniques: Density Estimation-Parzen windows- K-nearest neighbor estimation-Nearest neighbor rule- Metrics and nearest neighbor classification- Fuzzy classifications-Reduced Coulomb energy networks.

Unit III - Linear Discriminant Functions: Linear Discriminant Functions and Decision Surfaces-Generalized linear functions- Two- category linearly separable case- The Ho-Kashyap procedures- Linear programming algorithms- Support vector machine- Multi category Generalizations.

Unit IV - Stochastic and Non Metric Methods: Stochastic Search- Boltzmann Learning-Boltzmann networks and graphical models- Evolutionary Methods-Genetic programming- Decision Trees- CART- Recognition with strings-Grammatical methods-Grammatical inference-Rule based methods.

Unit V - Unsupervised Learning and Clustering: Mixture densities and Identifiability-Maximum likelihood estimates-Application to normal mixtures- Unsupervised Bayesian Learning- Data Description and Clustering-

Criterion Functions for Clustering-Iterative optimization- Hierarchical clustering- On-line clustering- Component analysis.

Reference Books:

1. R. O. Duda, P. E. Hart and D. G. Stork, Pattern Classification, John Wiley, 2006. ISBN-13: 978-8126511167.
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, Academic Press, Fourth Edition, 2008. ISBN-10: 1597492728.
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, First Edition, 2006. ISBN-10: 0387310738.
4. E. Gose, R. Johnsonbaugh, S. Jost, Pattern Recognition and Image Analysis, PHI,1997 (Digital Print - 2007). ISBN: 0132364158, 9780132364157
5. Earl Gose, Richard Johnsonbaugh, Steve Jost, Introduction to Pattern Recognition: A Matlab Approach, Academic Press, 2010. ISBN: 0080922759, 9780080922751.
6. Frank Y. Shih, Image Processing and Pattern Recognition: Fundamentals and Techniques, John Wiley and Sons, 2010, ISBN: 0470590408, 978047059040

17CS3056 PERVASIVE COMPUTING

Credits: 3:0:0

Course Objectives:

Enable the student to:

- gain an insight into future developments in the field of pervasive computing
- provide an in depth knowledge on pervasive computing and wireless networking
- describe the variety of pervasive services and applications

Course Outcomes:

The Student will be able to

- describe the principles of pervasive technology
- identify the functionalities of operating systems and middleware
- demonstrate the wireless application protocol and the different service discovery protocols
- analyze the device management and synchronization techniques
- explain the various gateways
- choose the appropriate techniques to develop various pervasive applications

Unit I - Introduction to Pervasive Computing: Times are Changing - Decentralization continues - Applied Pervasive computing - Pervasive computing principles - Pervasive Information Technology - Smart Cards - Smart Labels - Embedded Controls - Smart sensors and Actuators - Smart Appliances - Appliances and Home Networking -Automotive Computing.

Unit II - Operating Systems and Middleware: Windows CE -Palm OS - Symbian EPOC - Java Card - Windows for Smart Cards - Middleware Components - Programming Consumer Devices - Smart Card Programming - Messaging Components - Database Components.

Unit III - Mobile Internet, Voice and Service Discovery: The WAP Architecture - Wireless Application Environment - WAP 2.0 Architecture - Voice Technology Trends - Voice on the web - Standardization - Connectivity in Wireless Wide Area Networks - Short Range Wireless Communication - Home Networks - Universal Plug and Play - Jini - Salutation.

Unit IV - Gateways, Device Management and Synchronization: Connectivity Gateway - Wireless Gateway - Transcoding - Residential Gateway - Architecture and components of Web Application Servers - WebSphere Application Server WebSphere Everyplace Suite - Oracle Portal-to-Go - Tasks of Device Management Systems - Tivoli Device Support Infrastructure - User Profiles and Directory Services - Synchronization - The Challenge of Synchronizing Data - Industry Data Synchronization Standards -Today's Synchronization Solution.

Unit V - Portals and Access Services: Internet Portals-Wireless Portal - Broadcasting Portal - Home Services - Communication Services - Home Automation - Energy Services - Security Services - Remote Home Healthcare Services - Travel and Business Services - Consumer Services.

Reference Books:

1. Uwe Hansmann, Lothar Merk, Martin S. Nicklous, Thomas Stober, Pervasive Computing Handbook, Springer, 2001, ISBN 3-540-6712.
2. Asoke K Taukder, Roopa R Yavagal, "Mobile Computing", Tata McGraw Hill Pub Co., New Delhi, 2005, ISBN 978007 0588073
3. Asoke K Talukder, Roopa R Yavagal, Mobile computing: Technology, Applications and Service Creation, Tata McGraw-Hill Publishing Company Limited, 2005, ISBN 0 - 07 - 058807 - 4.

17CS3057 QUANTUM COMPUTING

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the quantum model of computation
- assess through the details of the fundamental quantum algorithms developed by deutsch, jozsa and simon's
- investigate the implications of quantum computing for the algorithm with super polynomial speedup, based on amplitude amplification and techniques of quantum error correction.

Course Outcomes:

The student will be able to

- state the basics of quantum computing next to the interface of computer, engineering, mathematical and physical sciences
- paraphrase the quantum information theory used to model information-related process
- relate real-time application like searching internet, modeling the national economy, forecasting the weather.
- analyze quantum algorithm used as a subroutine in several applications and estimate the phase that a unitary transformation adds to one of it eigenvectors.
- summarize that quantum computing is considerably advantageous to random access machine in multidimensional data processing
- relate quantum error correction and fault tolerant computation using three and nine qubit quantum code techniques.

Unit IL Introduction: Quantum computing, from bits to Qubits, Power of Quantum Computing, Quantum Mechanics & Computer Perspectives - Quantum Gates, Single Qubit, Multiple Qubit gates, Gates and Circuits.

Unit II - Applications: Quantum Teleportation, Quantum Parallelism, Superdense Coding, Quantum Communication. Introductory quantum algorithms: Probabilistic quantum algorithms-Phase kickback, Deutsch algorithms, Deutsch algorithms-Jozsa algorithm - Simon's algorithm.

Unit III - Algorithm with Super Polynomial Speedup: Quantum phase estimation and the quantum Fourier – transform - Eigen value estimation-Finding orders-Finding discrete logarithms - Hidden subroots.

Unit IV - Algorithm based on Amplitude Amplification: Grover's Quantum search algorithm - Amplitude amplification - Quantum amplitude estimation & Quantum Counting - Searching without knowing the success probability.

Unit V - Quantum Error Correction: Classical error correction - The classical three bit code - Fault tolerance - Quantum error correction - Three and nine-Qubit Quantum codes - Fault tolerant Quantum computation.

Reference Books:

1. Vishal Sahni, Quantum Computing, Tata McGraw-Hill, 2011. ISBN-13: 978-0-07-065700- 7, ISBN-10: 0-07-065700-9.
2. Phillip Kaye, Raymond Laflamme, An Introduction to Quantum Computing, Oxford University Press, 2010. ISBN-10: 0-19-85700-07, ISBN-13: 978-0-19-857000-4.
3. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information ,Cambridge University Press,10th anniversary edition, December 2010. ISBN-10: 0-52-16350-39, ISBN-13: 978-0-52-163503-5.
4. Willi-Hans Steeb, YorickHardyi World Scientific, 2016. ISBN-10: 9-81-25674-02, ISBN-13: 978-9-81-256740-6.
5. Mika Hirvensalo, Quantum Computing, Springer, 2004, ISBN - 3540407049

17CS3058 REAL TIME SYSTEM SOFTWARE

Credits: 3:0:0

Course Objectives:
Enable students to

- understand the main underlying theoretical and practical problems.
- validate formal specifications, of real-time systems, with the aid of software tools for the verification and analysis.
- explore programming structures for real-time systems monitoring and testing.

Course Outcomes:
Students will be able to

- relate the Real-Time Systems with Process and State Based Systems Model.
- classify the types of Data Flow Diagrams and Tabular Languages.
- illustrate the real-time scheduling algorithms.
- determine clock functionalities in real-time applications
- setup the Execution Time and Measurement of Software by a software
- choose suitable real-time languages for identical real-time processing.

Unit I - The world of real time systems: Software Architecture-Process and State Based Systems Model - Cyclic Executives.
Unit II - Requirements and design specifications: Survey and Classifications of Notations - Data Flow Diagrams - Tabular Languages - State Machines - Systems of State Machines - Communicating Real Time State Machines - State chart.
Unit III - Declarative specifications: Regular Expressions and Extensions –Traditional Logics - Real-Time Logic - Deterministic Scheduling - Assumptions and Candidate Algorithms - Basic RM and EDF Results - Relaxing the Assumptions - Process Interactions.
Unit IV - Execution time prediction: Measurement of Software by software - Program Analysis with Timing Schema - Prediction by optimization - System Interferences and architectural - Keeping Time on computers - Timer applications-properties of real and Ideal Clocks - Clock Servers –Clock synchronization.
Unit V - Programming languages: –Real time Language features - Ada - Java and real time extensions –CSP and Occam - Ethereal Concepts - Operating Systems Real time functions and services - OS architectures - Issues in Task Management - Interrupts and the OS.

Reference Books:

1. C. M. Krishna, Kang G. Shin, Real-Time Systems, McGraw-Hill International Edition 2010. ISBN: 0-07-070115-6.
2. Jane W. S. Liu, Real-Time Systems, Pearson Education, Eighth Impression, 2009, ISBN: 978-81-7858-575-9.
3. Rob Williams, Real-Time Systems Development, Butterworth-Heinemann, 2005, ISBN0080456405.
4. Phillip A. Laplante, Real-Time Systems Design and Analysis, Edition3, John Wiley and Sons, 2004 ISBN 0471648280.
5. Alan C. Shaw, Real–Time Systems and Software, Wiley, 2002. ISBN: 9814-12-657- 8.

17CS3059 REAL TIME SYSTEMS

Credits: 3:0:0

Course Objectives:
Enable the student to

- comprehend the fundamental concepts, algorithms and protocols for scheduling and validating of real-time systems.
- understand the design and evaluation issues in real-time systems.
- grasp the real-time database concepts

Course Outcomes:
The Student will be able to

- identify the types of real-time systems.

- predict influencing parameter in static and dynamic scheduling algorithms.
- demonstrate periodic, aperiodic and sporadic tasks scheduling.
- illustrate the role of priority based algorithms in real-time systems
- explain practical factors for scheduling the tasks in the real-time system.
- describe the real-time scheduling knowledge in database and fault-tolerant system.

Unit I - Realtime systems and real time scheduling: Introduction - Issues in Real-time Computing - Task Classes. Jobs and Processors - Real times, Deadlines and Timing constraints - A Reference model of Real time systems: Processors and resources - Temporal parameters of Real time workload - Precedence constraints and data dependency –Functional Parameters - Scheduling hierarchy. Real time scheduling algorithms.
Unit II - Clock-driven and priority-driven scheduling of periodic tasks: Clock-driven scheduling– General structure of Cyclic schedules - Scheduling Sporadic jobs - Practical considerations - Algorithm for constructing Static schedules - Pros and Cons of Clock driven scheduling. Priority-driven scheduling of Periodic jobs - Maximum schedulable utilization - Optimality of RM and DM algorithms - Practical factors.
Unit III - Scheduling aperiodic and sporadic jobs in priority driven systems: Assumptions and Approaches - Deferrable servers - Sporadic servers - Constant Utilization, Total bandwidth and weighted fair - queuing servers - Slack stealing in Deadline-Driven Systems - Slack stealing in Fixed-Priority Systems.
Unit IV - Resources and resource access control: Assumptions on resources and their usage - Effects of resource contention and resource access control - Non-preemptive Critical Sections - Basic Priority Inheritance Protocol - Basic Priority Ceiling Protocol - Stack Based Priority ceiling Protocol - Use of Priority Ceiling Protocol in Dynamic Priority System - Preemption Ceiling Protocol - Controlling access to multiple unit resources - Controlling concurrent accesses to data objects.
Unit V - Real time database and fault-tolerant system: Real-time Databases: Introduction - Basic Definitions - Main memory databases - Transaction priorities - Transaction aborts - Concurrency control issues - Disk Scheduling algorithms - Maintaining serialization consistency - Fault-tolerant Techniques: Introduction - What causes failures - Fault types - Fault Detection - Fault and Error Containment - Redundancy - Data diversity - Reversal Checks - Malicious or Byzantine Failures - Integrated failure handling.

Reference Books:

1. Jane W.S. Liu, Real-Time Systems, Pearson Education, 2006. ISBN: 9788177585759.
2. C. M. Krishna, Kang G. Shin, Real-Time Systems 2009, McGraw-Hill International Edition. ISBN: 9780070701151.
3. Phillip A. Laplante, Real-Time Systems Design and Analysis, Prentice Hall of India, Third Edition, 2006. ISBN 9788126508303.
4. Real-Time Systems Design and Analysis: Tools for the Practitioner Phillip A. Laplante, Seppo J. Ovaska, Fourth Edition, John Wiley and Sons, 2011, ISBN-1118136594.
5. Rob Williams, Real-Time Systems Development, Butterworth-Heinemann, 2005 ISBN- 0080456405.
6. Albert M. K. Cheng, Real-Time Systems: Scheduling, Analysis, and Verification, John Wiley and Sons, 2003 ISBN-0471460842.

17CS3060 REQUIREMENTS ENGINEERING

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the current techniques, methods, processes and tools used in requirement engineering.
- analyze significance of vision and scope in the software requirement specification.
- evaluate different approaches to model requirement engineering process.
- assess the importance of human, social and organization factors.

Course Outcomes:
The student will be able to

- identify the steps involved in the requirement engineering.
- describe the vision and scope of the project.
- prepare requirement documentation for a project.
- compare the requirements specification of various requirements models.

- Create the design for the requirements.
- Evaluate and estimate the requirement process.

Unit I - Software Requirements Introduction: Software requirements defined- Requirements development and management - When bad requirements happen to good people - Benefits from a high - quality requirements process - The expectation gap - Who is the customer? The customer -development partnership - Creating a culture that respects requirements - Identifying decision makers- Reaching agreement on requirements - A requirements development process framework-Good practices requirements elicitation, analysis, specification, validation, management, knowledge, project management- Getting started with new practices- The business analyst role, tasks, skill, knowledge- The making of a business analyst- The analyst role on agile projects- Creating a collaborative team.

Unit II - Requirement Development: Defining business requirements- Vision and scope document- Scope representation techniques- Keeping the scope in focus- Vision and scope on agile projects- User classes- Connecting with user representatives- The product champion- Use cases and user stories- The use case approach- Benefits of usage-centric requirements.

Unit III - Documenting the requirements: The software requirements specification- A software requirements specification template- Characteristics of excellent requirements- Guidelines for writing requirements- Modeling the requirements- From voice of the customer to analysis models- Data flow diagram- Swimlane diagram- State-transition diagram and state table- Dialog map- Decision tables and decision trees- Event-response tables- Modeling on agile projects.

Unit IV - Requirement Management: Requirements management process- The requirements baseline, version control, attributes- Tracking requirements status- Measuring requirements effort- Managing requirements on agile projects- Why manage changes- Managing scope creep- Change control policy- Basic concepts of the change control process- A change control process description- The change control board- Change control tools- Measuring change activity- Change management on agile projects- Tracing requirements- Motivations for tracing requirements- The requirements traceability matrix- Tools for requirements tracing- A requirements tracing procedure.

Unit V - Improving the requirement Process: How Requirements Relate to Other Project Processes- Requirements and various stakeholder groups- Fundamentals of software process improvement- The process improvement cycle- Requirements engineering process assets- Creating a requirements process improvement road map- Fundamentals of software risk management- Requirements-related risks.

Reference Books:

1. Karl E. Wiegers, Software Requirements, Wiley India Private Limited; Third edition 2013. ISBN-10: 9351192032 ISBN-13: 978-9351192039
2. Elizabeth Hull, Ken Jackson, Jeremy Dick, Requirements Engineering, Third Edition, Springer Publication, 2011. ISBN: 9781849964050.
3. Murali Chemuturi Requirements Engineering and Management for Software Development Projects, Springer, 2013, ISBN: 978-1-2614-5377-2
4. Ralph R. Young, Effective Requirements Practices, Addison Wesley, 2001. ISBN: 0-201-70912-0.
5. Richard H. Thayer, Merlin Dorfman, Sidney C. Bailin, Software Requirements Engineering, Second Edition, Wiley, 1997 Digitized 2009, ISBN: 0818677384

17CS3061 SEMANTIC WEB

Credits: 3:0:0

Course Objectives:

Enable the student to

- describe ontology for representing various semantics
- design semantic based rules to represent knowledge for real time applications
- develop context aware web applications using semantics

Course Outcomes:

The student will be able to

- define the different taxonomies in semantic web
- identify the various inference problems
- employ RDF schema for representing the knowledge required for various applications

- model rules to solve various real time problems
- design reasoners for various applications based on semantics
- appraise various semantic based applications

Unit I - Introductory Concepts: Syntactic Web - Semantic Web - Working and side effects - Ontology - Differences among taxonomies, thesauri and ontologies - Classifying Ontologies - Web ontology description languages - Ontologies, categories and Intelligence.
Unit II - Knowledge Representation in Description Logic: Family of attribute languages - Inference Problems - XML Essentials - RDF - RDF Schema.
Unit III - Ontology Web Language: Requirements for Web Ontology Description Languages - Header Information, Versioning and Annotation Properties - Properties - Classes - Individuals - Datatypes - Usage Scenarios for Rule Languages - Datalog - RuleMl - SWRL - TRIPLE.
Unit IV - Technology: Web Service Essentials - OWL-S Service Ontology - An OWL-S Example - Methods for Ontology Development - Metadata - Upper Ontologies - Metadata and Ontology Editors - Reasoners.
Unit V - Applications: Software Agents - Semantic Desktop - Geospatial Semantic Web - Geospatial Concepts - Classifying Geospatial Features - Gazetteers - Geospatioal Metadata.

Reference Books:

1. Karin K. Breitman, Marco Antonio Casanova, Walter Truszkowski, Semantic Web Concepts, Technologies and Applications, Springer, 2013, ISBN 978-81-8489-397-7.
2. Diester Fensel, James Hendler, Henry Lieberman, Wolfgang Wahlster, Spinning the Semantic Web, The MIT Press, 2005, ISBN 0-262-56212-X .
3. Jorge Cardoso, Semantic Web Services: Theory, Tools and Applications, Idea Group Pub, 2007,ISBN 9781599040455.
4. Toby Segaran, Colin Evans , Jamie Taylor, Programming the Semantic Web, ,Oreilly, 2009, ISBN- 10: 0596153813.
5. Grigoris Antoniou, Paul Groth,Frank van Harmelen, A Semantic Web Primer, Third Edition,2012, ISBN-978-0-262-01828-9.
6. Vladimir Geroimenko,Chaomei Chen, Visualizing the Semantic Web: XML-based Internet and Information Visualization, Second Edition, Springer-Verlag London Limited,2006, ISBN 1-85233-976-4.
7. Bo Leuf, The Semantic Web, Crafting Infracture for Agency, Wiley 2006, ISBN-13 978-0-470- 01522-3.

17CS3062 SOFT COMPUTING

Credits: 3:0:0

Course Objectives:
Enable the student to

- learn the unified and exact mathematical basis as well as the general principles of various soft computing techniques and hybrid systems.
- gain thorough understanding of the theoretical and practical aspects of soft computing.
- identify relevant technique and tool to solve the real-world applications.
- design and evaluate the performance of the real-world applications.

Course Outcomes:
The student will be able to

- describe the principles of biological systems and the concept of learning through soft computing techniques
- summarize the theoretical and practical aspects of different soft computing and hybrid techniques.
- demonstrate the steps involved in the development of application.
- analyze the problem thoroughly and identify the appropriate technique to derive the model
- design, implement and validate the computing systems by using appropriate technique and tools for any real world application.
- interpret the results obtained and suggest appropriate solution to the practical problem.

Unit I - Introduction to Soft Computing: Artificial Neural Networks - Fuzzy Logic - Genetic Algorithm - Hybrid Systems.
Unit II - Artificial Neural Networks: Basis Concepts - McCulloch-Pitts Model - Neural Network Architectures - Characteristics of Neural Networks - Learning Laws - Single Layer Perceptron - Multiple Layer Perceptron - Radial

Basis Function - Hopfield Network - Auto associative Memory - Hetero associative Memory - Bidirectional Associate Memory - Basics of Clustering - Competitive Learning Networks - Similarity / Dissimilarity Measures - Clustering Criteria - Different Distance Functions and Similarity Measures - Kohnen's Self Organizing Networks - Learning Vector Quantization - Adaptive Resonance Theory - Applications.

Unit III - Fuzzy Logic: Introduction - Classical Sets and Fuzzy Sets - Crisp Vs Non-Crisp Representation - Classical Relations - Fuzzy Relations - Properties of Membership Function - Fuzzy Operations - Fuzzy Logic - Fuzzification - Fuzzy If-Then Rules, Fuzzy Reasoning - Architecture of Fuzzy Interference Systems - Mamdani Fuzzy Models - Sugeno Fuzzy Models - Defuzzification - Fuzzy C-Means Clustering - Applications.

Unit IV - Optimization Algorithms: Introduction to Single-objective Optimization - Objective Function - Genetic Algorithm - Differential Evolution - Particle Swarm Optimization - Ant Colony Optimization - Artificial Bee Colony Optimization - Introduction to Multi-objective Optimization.

Unit V - Hybrid Systems: Introduction - Integration of Soft Computing Techniques - Neuro-Genetic Systems - Neuro-Fuzzy Systems - ANFIS Architecture - Fuzzy-Genetic Systems - Applications.

Reference Books:

1. S. Rajasekaran and G.A.V. Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI, 2011, ISBN: 978-81-203-2166-1.
2. S.N.Sivanandam and S.N.Deepa, Principles of Soft Computing, 2nd edition, Wiley India Pvt Ltd, 2011, ISBN-10: 8126527412, ISBN-13: 978-8126527410.
3. Xin-She Yang, Nature-Inspired Optimization Algorithms, 1st edition, Elsevier Inc, 2014, ISBN-10: 0124167438, ISBN-13: 978-0124167438.
4. J.S.R.Jang, C.T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing - A Computational Approach to Learning and Machine Intelligence, PHI/Pearson Education 2004, ISBN: 0-13-261066-3.
5. Samir Roy and Udit Chakraborty, Introduction to Soft Computing - Neuro-Fuzzy and Genetic Algorithms, Pearson, 2013, ISBN:978-81-317-9246-9.
6. James A. Freeman, David M.Skapura, Neural Networks Algorithms, Applications and Programming Techniques, Pearson, 2007, ISBN:978-81-317-0808-8.
7. Laurene Fausett, Fundamentals of Neural Networks - Architectures, Algorithms and Applications, Pearson, 2013, ISBN:978-81-317-0053-2.
8. David E. Goldberg, "Genetic Algorithm in Search Optimization and Machine Learning" Pearson Education India, 2013, ISBN-13: 978-0201157673.

17CS3063 SOFTWARE AGENTS

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the concept of agents, multi-agent systems and the key issues surrounding the design of intelligent agents.
- solve distributed problems using agent technology.
- develop the multi- agent based application using JADE

Course Outcomes:

The student will be able to

- describe agents, multi-agents and its applications
- distinguish different types of agent architecture
- demonstrate various coordination algorithms
- identify suitable agent communication language for implementing multi -agent communication
- design suitable agent based algorithms for solving complex problems
- interpret and evaluate the applications developed in JADE platform

Unit I - Introduction: Intelligent Agents - Deductive Reasoning Agents - Agents as theorem provers - Agent Oriented Programming - Concurrent MetateM.

Unit II - Practical Reasoning Agents: Reactive and Hybrid Agents - Brook's and Subsumption Architecture - Limitations of Reactive Agents - Hybrid agents - Multiagent Interactions - Making Group Decisions.

Unit III - Forming Coalitions: Allocating Resources - Bargaining - Argumentation - Sharing-Understanding.

Unit IV - Communication Languages: Working Together - Cooperative Distributed Problem Solving - Task Sharing and Result Sharing -Coordination - Multiagent Planning and Synchronization - Applications**.**
Unit V - JADE: The JADE Platform - Programming with JADE - Basic Features.

Reference Books:

1. Michael Wooldridge, An Introduction to Multi Agent Systems, Second Edition, John Wiley and Sons Ltd, 2009. ISBN: 978-0-470-51946-2.
2. Fabio Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multiagent Systems with JADE, John Wiley and Sons Ltd, 2007. ISBN: 978-0-470-05747-6.
3. Gerhard Weiss, Multiagent Systems (Intelligent Robotics and Autonomous Agents series), MIT Press, Second Edition, March 2013. ISBN - 13: 978-0262018890.
4. YoavShoham, Kevin Leyton-Brown Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press, 2009, ISBN113947524X

17CS3064 SOFTWARE ARCHITECTURE

Credits: 3:0:0

Course Objectives:
Enable the student to

- learn about the concepts, principles, and state-of-the-art methods in software architecture
- identify the role of the architects, including domain-specific software architectures
- study the various architectural styles, architecture description languages
- know about the software connectors and architecture-based testing and analysis

Course Outcomes:
The student will be able to

- describe various software architecture relevant to real time applications
- predict the role of software architects in various software projects
- use various architectural description languages
- illustrate architecture-based testing and analysis
- develop new architectural styles based on the architectural description languages
- interpret the results of architecture based testing based on the models developed by the architects

Unit I - An Engineering Discipline for software: The Status of Software Architecture - Architectural Styles - Data Abstraction and object oriented organization - Layered Systems - Interpreters - process control - Heterogeneous Architectures
Unit II - Instrumentation software: Mobile Robotics - Cruise Control - Three vignettes in mixed Style - Shared Information systems - Database Integration - Integration in the software development environments - Integration in the design of buildings - The quantified design space
Unit III - Formal models and specifications: The value of Architectural formalism - Formalizing the architecture of a specific system - Formalizing an architectural style - Formalizing an architectural design space - Toward a theory of software architecture
Unit IV - Linguistic Issues: Requirements for architecture description languages - First class connectors - Adding implicit invocation to traditional programming languages - Architectural design guidance
Unit V - Tools for architectural design - UniCon: A Universal Connector Language - Exploiting style in architectural design environments - Architectural Interconnection - Education Of Software Architects - Software Architects Course description

Reference Books:

1. Mary Shaw and David Garlan, Software Architecture: Perspectives on an Emerging Discipline, Prentice-Hall, 2005. ISBN: 82-203-1470-0.
2. Richard N. Taylor, Nenad Medvidovic and Eric Dashofy, Software Architecture: Foundations, Theory, and Practice, Wiley 2008. ISBN: 978-0-470-16774-8.
3. George Fairbanks, David Garlan, Just Enough Software Architecture: A Risk-Driven Approach, Marshall and Brainerd, 2010. ISBN: 0984618104.

4. Peter Eeles, Peter Cripps, The Process of Software Architecturing, Addison-Wesley, 2007. ISBN: 978-0-321-35748-9.
5. Len Bass, Paul Clements, and Rick Kazman, Software Architecture in Practice, Third edition, 2012. ISBN - 0321815734.

17CS3065 SOFTWARE ARCHITECTURE RESTRUCTURING

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the software structure without affecting the behavior of system.
- evaluate the design of the code after it has been written.
- infer the basics of software clustering.

Course Outcomes:

The student will be able to

- define the principles of refactoring.
- predict the impact of refactoring on the design of a system.
- illustrate software architecture using the software clustering techniques.
- analyze the quality of a software system.
- explain the nature of some of the problems encountered when maintaining complex software systems.
- evaluate appropriate solutions to improve reusability and maintainability of a software system, measure its quality and support its evolution.

Unit I - Refactoring: The Starting Point - The First Step in Refactoring - Decomposing and Redistributing the Statement Method - Replacing the Conditional Logic on Price Code with Polymorphism.

Unit II - Principles In Refactoring And Bad Smells In Code: Origin of Refcatoring - Defining Refactoring - Need of Refactoring - Impact of Refactoring - Indirection and Refactoring - Problems with Refactoring - Refactoring and Design - It Takes A While to Create Nothing - Refactoring and Performance - Optimizing a Payroll System - Duplicated Code - Long Method - Large Class - Long Parameter List - Divergent Change - Shotgun Surgery - Feature Envy - Data Clumps - Primitive Obsession - Case Statements - Parallel Inheritance Hierarchies - Lazy Class - Speculative Generality - Temporary Field - Message Chains - Middle Man - Inappropriate Intimacy - Alternative Classes with Different Interfaces - Incomplete Library Class - Data Class - Refused Bequest - Comments - Metaprogramming Madness - Disjointed API - Repetitive Boilerplate.

Unit III - Composing Methods: Extract Method - Inline Method - Inline Temp - Replace Temp with Query - Replace Temp with Chain - Introduce Explaining Variable - Split Temporary Variable - Remove Assignments to Parameters - Replace Method with Method Object - Substitute Algorithm - Replace Loop with Collection Closure Method - Extract Surrounding Method - Introduce Class Annotation - Introduce Named Parameter - Remove Named Parameter - Remove Unused Default Parameter - Dynamic Method Definition - Replace Dynamic Receptor with Dynamic Method Definition - Isolate Dynamic Receptor - Move Eval from Runtime to Parse Time.

Unit IV - Moving Features Between Objects and Big Refactorings: Move Method - Move Field - Extract Class - Inline Class - Hide Delegate - Remove Middle Man -The Nature of the Game - Why Big Refactorings Are Important - Four Big Refactorings - Tease Apart Inheritance - Convert Procedural Design to Objects - Separate Domain from Presentation - Extract Hierarchy.

Unit V - Dealing with Generalization: Pull Up Method - Push Down Method - Extract Module - Inline Module - Extract Subclass - Introduce Inheritance - Collapse Hierarchy - Form Template Method - Replace Inheritance with Delegation - Replace Delegation with Hierarchy - Replace Abstract Superclass with Module.

Reference Books:

1. Niels Streekmann, Clustering-Based Support for Software Architecture Restructuring, First Edition, ViewegTeubnerVerlag, 2011, ISBN: 978-3834819536.
2. Jay Fields, Shane Harvie, Martin Fowler, Kent Beck, Refactoring, First Edition, Addison- Wesley, 2009, ISBN: 978-0321984135.
3. Michael C.Feathers, Working Effectively with Legacy Code First edition, Pearson Education, 2004.

4. Robert C. Seacord, Daniel Plakosh and Grace A Lewis, Modernizing Legacy Systems: Software Technologies, Engineering Processes, And Business Practices. First Edition Pearson Education, 2003, ISBN: 978-0321118844.

17CS3066 SOFTWARE METRICS AND QUALITY MANAGEMENT

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand how to choose appropriate quality goals and to select, plan, and execute quality assurance activities throughout the development phase
- study the software quality engineering metrics and models
- learn the design methods for various software applications

Course Outcomes:

The student will be able to

- select the best quality assurance plan during software development
- classify software metrics and models in software development
- apply the traditional project management skills and manage resource requirements
- identify the suitable life cycle models for the software applications.
- formulate the design methods based on the projects
- select proper planning methods and execute projects

UNIT – I: Software Development Process Models: The waterfall Development model - The Prototyping Approach - The spiral Model - The iterative Development Process Model - The object - oriented Development Process - The clean room Methodology - The Defect Prevention Process - Process Maturity Framework and Quality Standards

UNIT – II: Software Quality Metrics Overview: Product Quality Metrics - In-Process Quality Metrics - Metrics for Software Maintenance - Collecting software Engineering Data. Applying the Seven Ishikawa's Seven Basic tools - Checklist - Pareto Diagram - Histogram - Run charts - Scatter Diagram - Control chart - Cause-and-Effect Diagram - Relations Diagram

UNIT – III: Exponential Distribution and Reliability Growth Models: Reliability Models - The Rayleigh Model - Basic assumptions - Implementation - Reliability and Predictive Validity - The Exponential Model - Reliability Growth Models - Criteria for Model Evaluation - Modeling Process - Test Compression Factor - Estimating the distribution of total defects over time.

UNIT – IV: In-Process Metrics and Reports: Orthogonal defeat classification - In-Process Metrics for Software Testing - Quality management - Halstead's Software Science - Cyclomatic Complexity - Syntactic Constructs - Structure Metrics - Oriented Concepts and Constructs - Design and Complexity Metrics - Productivity Metrics - Quality and Quality Management Metrics

UNIT – V: Conducting In-Process Quality Assessments: Preparation Phase -Evaluation Phase - Summarization Phase - Recommendations and Risk Mitigation - Audit and Assessment - Software Process Maturity Assessment and Software Project Assessment - Software Process Assessment Cycle - Do's and Don'ts of Software Process Improvement

Reference Books:

- John W. Horch, Practical Guide to Software Quality Management, Fourth Edition, Artech House Computer Library, 2013. ISBN: 0813170324.
- Stephen H. Kan, Metrics and Models in Software Quality Engineering, Second Edition, Pearson, 2003. ISBN: 813170324.
- John C. Munson, Software Engineering Measurement, Auerbach Publications, 2003. ISBN: 0849315034.
- Norman.E. Fenton and James Bieman , Software Metrics: A Rigorous and Practical Approach, Third Edition, Taylor & Francis, 2014. ISBN 1439838224, 9781439838228.

17CS067 SOFTWARE PROJECT MANAGEMENT

Credit: 3:0:0

Course Objectives:

Enable the student to

- understand traditional project management methodologies, resource requirements and cost.
- infer the purpose of different production phases on software management process framework.
- utilize the tools to build an effective project management infrastructure.

Course Outcomes:

The student will be able to

- describe the necessity of the systematic software management benefits and effectiveness.
- explain each phase of the software management process framework
- apply the assessment procedure on the management process to make a periodic review of its progress
- identify the tools to support the project environment to manage changes
- design the workflow of the management process with different checkpoints and milestones.
- describe the external factors that impacts the software management and the metric used to evaluate its performance.

Unit I - Software Management Renaissance: Conventional Software Management - The Waterfall Model - In Theory - In Practice - Conventional Software Management performance –Evolution of Software Economics - Software Economics - Pragmatic Software Cost Estimation - Reducing Software product Size - Reducing software product size - languages - Object - Oriented Method and Visual Modeling - Reuse - Commercial Components – Improving Software Processes - Improving Team Effectiveness - Improving Automation through software environments - Achieving Required Quality - Peer Inspections A pragmatic View - The Old way and the New - The principles of Conventional Software Engineering - The Principles of Modern Software management - Transitioning to an Iterative process.

Unit II - A Software Management Process Framework: Life-Cycle Phases- Engineering and Production stages - Inception Phase - Elaboration Phase - Construction Phase - Transition Phase - Artifacts of the process - The Artifacts of the process - The Artifact sets - The Management set - The Engineering set - Artifact Evolution over the life cycle - Test Artifact - Management Artifacts - Engineering Artifacts - pragmatic Artifacts

Unit III - Model-Based Software Architectures: A Management Perspective –A Technical Perspective - Workflows of the Process - Software process Workflows - Iteration workflows - Checkpoints of the process - Major milestones - Minor milestones –Periodic status Assessments.

Unit IV - Software Management Disciplines and Tools: Iterative Process Planning - work breakdown structures– Conventional WBS Issues - Evolutionary work Breakdown Structures - Planning Guidelines - The cost and schedule Estimating process - The Iteration planning process - Pragmatic planning - Project Organizations and Responsibilities - Line –of- Business Organizations - project organizations - Evolution of organizations - Process Automation –Automation Building Blocks - The project Environment - Round- Trip Engineering–Change Management - Infrastructures - Stakeholder Environments

Unit V - Project Control and process Instrumentation: The seven Core Metrics - Management Indicators - Work and progress- Budgeted Cost and Expenditures - Staffing and Team Dynamics - Quality Indicators - Change Traffic and Stability - Breakage and Modularity –Rework and Adaptability - MTBF and Maturity - Life –cycle Expectations - Pragmatic Software metrics - Metrics Automation.

Text Book:

1. Robert K. Wyzocki, Effective Project Management, Seventh Edition, WILEY-Dreamtech India Pvt. Ltd., 2013. ISBN: 978-1-118-72916-8

Reference Books:

1. Roger S Pressman, Pressman Roger, Software Engineering: A Practitioner's Approach, Seventh Edition, McGraw-Hill Higher Education, 2009. ISBN: 0073375977, 9780073375977.
2. Pankaj Jalote, Software project management in practice, Addison-Wesley, 2002. ISBN: 0201737213, 9780201737219.
3. Walker Royce ,Software Project Management - A Unified Framework , Pearson Education, 2004. ISBN: 0201309580, 9780201309584.

4. Bob huges, Mike cotterell, Software Project Management, Tata McGraw Hill, New Delhi, 2006, Edition: 4, ISBN: 13 978-0-07-710989-9, 10 0077109899.

17CS3068 SOFTWARE TESTING

Credits: 3:0:0

Course Objectives:
Enable the student to
- understand the basics of software testing and its strategies.
- learn about software quality evaluation policies and procedures.
- gather adequate knowledge on various testing methodologies.

Course Outcomes:
The student will be able to
- identify various types of errors and fault models.
- express the types of test goals, policies plans, and documentation.
- predict the behaviour of software defects, hypotheses and tests.
- analyze Test adequacy assessment using: control flow, data flow, and program mutations.
- explain various software testing tools.
- evaluate the types of test goals, policies plans, and documentation.

Unit I - Introduction to testing as an Engineering activity: Testing Fundamentals - Overview of the testing maturity model - Defects, hypotheses and tests - Origin of defects, Defect classes, the defect repository, test design - Defect Examples: the coin problem - Developer/ tester support for developing a defect repository.
Unit II - Strategies and methods for test case design I & II: The smart tester - test case design strategies -random testing - Equivalence class partitioning - boundary value analysis - White box testing to test design - Covering code logic Levels of testing.
Unit III - Test goals, policies, plans, and documentation: Test planning - Test plan attachments - Locating test items - reporting test results -The test organization - Career path for testers - Measurements and milestones for controlling & monitoring - Status meeting, reports & control issues.
Unit IV - Reviews as a testing activity: Expanding testing activity umbrella - types of reviews - Developing a review program - need for review policies - Components of review plans - A measurement program to support product and process quality - Evaluating software quality: a quantitative approach.
Unit V - The testers' workbench: The goals for testers workbench - Evaluating testing tools for the work bench - Tools categories - testers workbench & three critical views - The TMM structure - TMM assessment model design- TMM assessment model components Process control and optimization - The testing maturity model and test process assessment.

Reference Books:
1. Ilene Burnstein, Practical Software Testing, Springer International, 2003. ISBN: 0-387-95131-8.
2. William E. Perry, Effective Methods for Software Testing, Third Edition, John Wiley, 2006.ISBN: 978-0764598371.
3. Srinivasan Desikan, Gopalaswamy Ramesh, Software Testing: Principles and Practice, Pearson Education India, 2006, ISBN-817758121X.
4. Brian Hambling, Angelina Samaroo¸ Software Testing, Publisher BCS, The Chartered Institute, 2009, ISBN - 1906124132.
5. Elfriede Dustin, Effective Software Testing, Pearson Education, 2003. ISBN: 81-297-0048-4.

17CS3069 USER INTERFACE DESIGN

Credits: 3:0:0

Course Objectives:
Enable the student to
- provide an introduction to the human computer interface.
- address the interface and screen design from the user's perspective.
- study and understand the testing methods.

Course Outcomes:
The student will be able to

- identify reasoning behind the guidelines and use of the design methods.
- summarize interesting possibilities for supporting users in the performance of their tasks and design user interfaces for business web applications.
- apply design principles, guidelines and heuristics to create a user-interaction strategy that solves a real-world problem.
- select a usable and compelling user-interface given a set of requirements and available technologies.
- Assemble effectively the designed user-interface to relevant stakeholders using design rationale and a sketching presentation tool in an informed, reasonable and persuasive way.
- assess an evaluation of a user-interface by employing a series of evaluation methods available in usability engineering.

Unit I - Human Factors of Interactive Software: Introduction - Goals of System Engineering - User Interface Design Goals -Motivations for Human Factors in Design - Accommodating HumanDiversity - Goal for our Profession - Theories, Principles, and Guidelines - High-LevelTheories - Object/Action Interface Model - Principles - Guidelines for Data Display - Guidelines for Data Entry - Balance of Automation and Human Control.
Unit II - Managing Design Processes: Introduction - Organizational Design to Support Usability - The Three Pillars of Design - Development Methodologies - Ethnographic Observation - Participatory Design Scenario Development - Social Impact Statement for Early Design Review - Legal Issues Expert Reviews, Usability Testing, Surveys, and Continuing Assessments - Introduction - Expert Reviews - Usability Testing and Laboratories -Surveys - Acceptance Tests - Evaluation During Active Use - Controlled Psychologically-Oriented Experiments - Software Tools - Specification Methods - Interface-Building Tools - Evaluation and Critiquing Tools.
Unit III - Direct Manipulation and Virtual Environments: Introduction - Examples of DirectManipulation Systems - Explanations of Direct Manipulation - Visual Thinking and Icons –Direct-Manipulation Programming - Home Automation -Remote Direct Manipulation - Virtual Environments Menu Selection, Form Filling, and Dialog Boxes -Task-Related Organization - Item Presentation Sequence - Response Time and Display Rate - FastMovement Through Menus - Menu Layout - Form Filling - Dialog Boxes.
Unit IV - Multiple-Window Strategies: Introduction - Individual -Window Design -Multiple-Window Design - Coordination by Tightly-Coupled Windows - Image Browsing and Tightly-Coupled Windows -Personal Role Management and Elastic Windows - Computer-Supported Cooperative Work - Introduction - Goals of Cooperation - Asynchronous Interactions:Different Time, Different Place - Synchronous Distributed: Different Place, Same Time - Face to Face - Same Place, Same Time - Applying CSCW to Education
Unit V - Information Search, Visualization and World Wide Web: Introduction - Database Query and Phrase Search in Textual Documents - Multimedia Document Searches-Information Visualization - Advanced Filtering - Hypermedia and the World Wide Web - Introduction - Hypertext and Hypermedia- World Wide Web - Genres and Goals for Designers - Users and Their Tasks –Object Action Interface Model for Web Site Design.

Reference Books:

1. Wilbert. O. Galitz, The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, John Wiley and Sons, 2007. ISBN 81-265-0280-0.
2. Ben Shneiderman, Maxine Cohen, Designing the user interface-Strategies for Effective Human-Computer Interaction, Fifth Edition, Pearson Education, 2008. ISBN:13:780321537355
3. Soren Lauesen, User Interface Design: A Software Engineering Perspective, Pearson / Addison-Wesley, 2005, ISBN 0321181433
4. Alan J. Dix, Janet E. Finlay, Gregory D. Abowd, Russell Beale, Janet E. Finley., Human-Computer Interaction, Third Edition, Prentice Hall, 2004. ISBN 978-0130461093

17CS3070 VIRTUAL REALITY TECHNOLOGY

Credits: 3:0:0
Course Objectives:
Enable the student to

- understand the fundamental principles of virtual reality.
- infer the essential information about the hardware and software in virtual environment.
- design and construct a simple virtual environment.

Course Outcomes:

The student will be able to

- recognize the virtual technology and usage of input devices.
- identify the essential output devices, sound displays, graphics and feedback.
- demonstrate workstation based architecture for modeling.
- analyze the programming tool kits in engineering the virtual reality methods.
- relate the user performance and multimodality feedbacks.
- estimate the effect of virtual reality simulation on users.

Unit I - Introduction & History of Virtual Reality: Commercial VR Technology- Input Devices- Tracker Performance Parameters- Mechanical- Magnetic- Ultrasonic- Optical- Hybrid- Navigation and Manipulation Interfaces- Gesture Interfaces.

Unit II - Output Devices: Graphic Displays - Sound Displays-The Human Auditory System- The Convolvotron - Haptic Feedback: The Human Haptic System- Tactile- Force- The Graphics Rendering Pipeline- PC Graphics Architecture- Graphics Benchmarks.

Unit III - Workstation based Architecture: Workstation Based Architectures: The Sun Blade 1000 - The SGI Infinite Reality - Distributed VR -Multi pipeline Synchronization- Colocated Rendering- Distributed Virtual Environments- Geometric - Kinematics Modeling- Physical- Behavior- Model Management.

Unit IV - Virtual Reality Programming: VR Programming: Toolkits and Scene Graphs- World ToolKit- Java 3D- General Haptics Open Software Toolkit- People Shop-Usability Engineering Methodology.

Unit V - User Performance Studies: Test bed Evaluation of Universal TR Tasks- Influence of Feedback Multimodality- VR Health and Safety Issue- Direct effect of VR Simulation on Users- Cyber sickness- Adaptation and Aftereffects, Guidelines for Proper VR Usage- VR and Society.

Reference Books:

1. GrigoreC.Burdea and Philippe Coiffet, Virtual Reality Technology, Third Edition, John Wiley and Sons, 2012,ISBN-13: 978-1118014806.
2. Gerard Kim, Designing Virtual Reality Systems: The Structured Approach, Springer, 2007, ISBN: 1846282306, 9781846282300.
3. John Vince, Introduction to Virtual Reality, Springer, 2004, ISBN: 1852337397, 9781852337391.
4. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design, Morgan Kaufmann publisher, 2003, ISBN: 1558603530, 9781558603530.
5. Alan B. Craig, William R. Sherman, Jeffrey D. Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009, ISBN: 0080959083, 9780080959085.

17CS3071 WEB SECURITY

Credits: 3:0:0

Course Objectives:

Enable the student to

- have a wide understanding of the various threats in the internet.
- gain knowledge about security threats at user and sever level, transaction level.
- know about commerce and legal issues in the web.

Course Outcomes:

Students will be able to

- identify the software security vulnerabilities in existing systems.
- discuss methods for authentication, access control, intrusion detection and prevention.
- apply the correct security measures for each threat.
- analyze the fundamental principles of access control models and techniques, authentication and secure system design
- design mechanisms to securely transfer information from the sender to the receiver.
- explain the role of firewalls, IPSec, Virtual Private Networks and identity management, etc.
- compare web server vulnerabilities and their counter measures.

Unit I - Introduction: The architecture of World Wide Web- Common threats on the Web- The Web Security Landscape-User Security- Web Server Security- Security of data transaction between user and the web server- Cryptography Basics- Cryptography and the Web.
Unit II - Privacy-protection Techniques: Privacy-protecting Technologies- Backups and Antitheft- Mobile Code I: Plugin's, ActiveX- Mobile Code II: Java, JavaScript, Flash and Shockwave- Digital Certificates- Digital Identification Techniques.
Unit III - Certification Authorities and Server Certificates: Client Side Digital Certificates- Code signing and Microsoft's Authenticode- Physical security of servers- Host security for servers- Securing web applications- Deploying SSL server certificates- Securing your Web Service.
Unit IV - Controlling access to your web content: Secure CGI/API programming- SSL/TLS protocol- Secure Authentication and Messaging- understanding public key infrastructure- Firewall solutions- Intrusion Detection System.
Unit V - Disaster Recovery & Backups: Digital Payments- Blocking Software and Censorship Technologies- Legal issues: civil; Legal issues: Criminal- Intellectual Property and Actionable Content.

Reference Books:

1. Simpson Garfinkel, Gene Spafford, Web Security, Privacy and Commerce, O'Reilly, Second Edition, 2002. ISBN: 978-0-596-00045-5.
2. ShwetaBhasin, Web Security Basics, Premier Press, 2003. ISBN: 1-59200-006-1.
3. Simpson Garfinkel, Eugene H. Spafford, Web Security and Commerce, O'Reilly, First Edition. ISBN:1-56592-269-7.

17CS3072 WEB SERVICES

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand web service technology and usage.
- get a general idea about the models and architectures of web services.
- demonstrate how to develop, deploy and manage web services application with JWS Developer pack.

Course Outcomes:
The student will be able to

- describe the core standards, protocols and security technologies of web Service Architecture.
- explain the role of core technologies in Web Service development.
- demonstrate the interoperability of web services in distributed computing.
- choose the suitable XML JAVA API tool for implementing web services.
- create and publish Web Services using JAVA API.
- support the web services with interoperability and security.

Unit I - Introduction to web services: distributed computing - message oriented middleware - motivation and characteristics of web services - basic operational model - core web services standards - challenges in web services - web services software and tools.
Unit II - Web service architecture: SOAP - WSDL - UDDI - ebXML - web services communication models - developing web services - building web services with JAX-WS - building restful services with JAX-RS - XML based protocols and SOAP.
Unit III - Web service technologies: developing web services using SOAP - anatomy of SOAP message - SOAP encoding - SOAP message exchange model - SOAP communication - SOAP messaging - SOAP bindings for transport protocols - SOAP security - web service description language(WSDL) - universal description discovery and integration(UDDI) - means of ensuring interoperability - challenges in creating web services interoperability.
Unit IV - JAVA web services developer pack: XML basics - implementing XML in e-business - JAVA API for XML processing - XSL style sheet - JAVA architecture for XML binding - role JAXM in web services - JAXM API programming model - role of JAX-RPC in web services - JAX-RPC APIs and implementation model - JAX-RPC supported JAVA/XML mappings - JAXR architecture - JAXR registry services API.
Unit V - Security in web services: XML encryption - XML signatures - XML key management specification - security - Assertions markup language - XML access control markup language.

Reference Books:

1. Ramesh Nagappan, Robert Skoczylas and Rima Patel Sriganesh, Developing JAVA Web Services, Wiley Publishing Inc, 2008, ISBN 10:81-265-0499-4/ISBN 13:978-81-265-0499-2.
2. Sandeep Chatterjee, James Webber, Developing Enterprise Web Services, Pearson Education, 2009, 8131713172, 9788131713174.
3. Schmelzer, XML and Web Services Unleashed, Pearson Education India, (2008), ISBN-10: 8131718697, 9788131718698.
4. Steve Graham, et al., Building Web Services with JAVA, Pearson Education, 2008, ISBN: 81-317-1813-1.
5. Martin Kalin, JAVA Web Services, O'reilly Publications, 2009, ISBN: 978-0-5916-52112-7.
6. Robert Daigneau, Service Design Patterns: Fundamental Design Solutions for SOAP/WSDL and RESTFUL Web Services, Pearson Education, 2011, ISBN-10: 8131794024, ISBN-13: 978-8131794029
7. G Alonso, Web Services: Concepts, Architectures and Applications, Orient Black Swan Publications, 2009, ISBN 10: 8184891709, ISBN 13: 9788184891706.

17CS3073 WIRELESS SECURITY

Credits: 3:0:0

Course Objectives:

Enable the student to

- identify various threats in wireless networks and security solutions.
- analyze the technologies and protocols that support security in wireless networks.
- appraise the improvements to be appended for enhancing wireless security.

Course Outcomes:

Student will be able to

- recognize the security challenges in wireless networks.
- discuss and distinguish the technologies that make up secured wireless network.
- relate the importance of providing security at user and server level.
- differentiate the key hierarchies of wireless security.
- combine Bluetooth and VOIP security.
- estimate the security of public wireless hotspots.

Unit I - Security principles: attacks - Distinguishing features of wireless - protecting privacy - promoting safety - 1G - 2G - 3G - 4G - Wi-Fi Vulnerabilities -changing the security model - Traditional Security Architecture - Options in Traditional Security Architecture - Different Types of Attacks - Classification of attacks - attacks without keys - attacks on keys.

Unit II - Wireless Information warfare: functional taxonomy based on wireless information warfare - Design of Wi-Fi Security - Layers - wireless LAN Organization - basics in infrastructure mode - Protocol Details - Radio Bits.

Unit III - IEEE 802.11 WEP Working and non-working & Access Control: Privacy - Mechanics of WEP - Why WEP is not secure - WPA, RSN and IEEE 802.11i - What is IEEE802.11i & WPA - difference between RSA and WPA - Security context - keys - IEEE 802.1X, EAP, and RADIUS - Importance - IEEE802.1x - EAP principles - EAPOL.

Unit IV - Upper Layer Authentication: TLS - Kerberos - LEAP - PEAP - TKIP - TKIP overview - implementation - AES CCMP - Overview - Wi-Fi LAN Coordination - ESS and IBSS- Public Wireless Hotspots - Securing Wireless LAN - Wireless Application Protocol.

Unit V - Bluetooth& Voice over IP: - Bluetooth Security Architecture -Threats to Bluetooth Security - jamming - VoIP Security -Voice Network Security vulnerabilities - IP Spoofing and VoIP.

Reference Books:

1. Jon Edney, William A. Arbaugh, Real 802.11 Security Wi-Fi Protected Access and 802.11i, Pearson Edition, Reprint 2007, ISBN: 0321136209.
2. Randall K.Nichols, Panos C. Lekkas, Wireless Security: Models, Threats and Solutions, Tata McGraw Hill, reprint 2006. ISBN-13: 978-0071380386.
3. Merrit Maxim, David Pollino, Wireless Security, McGraw-Hill, 2002, ISBN-13: 978-0072222869.

17CS3074 SOCIAL NETWORK ANALYSIS

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the concepts vital for social network analysis
- practice diverse percolation and community detection algorithms existing.
- select fitness function appropriate for the problems in social network analysis.

Course Outcomes:

The student will be able to

- identify social network analysis problems.
- recognize the diverse types of social networks available.
- manipulate the necessary synthetic network for their research.
- experiment a choice of models existing for Social network Analysis.
- develop fresh algorithms allied to percolation theory
- predict the subgroup structures existing in the real world network.

Unit I - Social Network Analysis: Vulnerability due to interconnectivity - Networks at the heart of complex systems - Two sources helped the emergence of network science - The characteristics of network science - Societal impact - Scientific impact - Graph Theory: The Bridges of Konigsberg - Networks and Graphs - Degree-Average degree - Degree distribution - Adjacency Matrix - Real networks are sparse - Weighted networks - Bipartite networks - Paths and Distances - Connectedness - Clustering coefficient

Unit II - Random networks: Introduction - Random network model - Number of Lines - Degree distribution - Real networks are not Poisson - The evolution of a random network - Real networks are supercritical - Small world - Clustering coefficient - The Scalle-Free Property - Power laws and Scale-Free network - Hubs - The meaning of Scale-Free - Universality - Ultra-small Property - The role of the degree exponent - Generating networks with arbitrary degree distribution.

Unit III - Social Network Analysis Models: The Barabasi - Albert Model - Growth and preferential attachment - degree dynamics - Degree Distribution - The absence of growth or preferential attachment - Measuring preferential attachment - non-linear preferential attachment - The origin of preferential attachment - Diameter and Clustering coefficient - Evolving Networks: The Bianconi-Barabasi model - Measuring fitness - Bose-Einstein Condensation.

Unit IV - Degree Correlations: Assortativity and Disassortativity - Measuring degree correlation - Structural Cutoffs - Correlations in Real networks - The impact of degree correlations - Network Robustness - Percolation theory - Attack tolerance - Cascading Failure - Building Robustness.

Unit V - Communities: Basics - Hierarchical - Modularity - Overlapping Clustering - Testing - Characterizing.

Reference Books:

1. Albert-László Barabási (Author), Márton Pósfai (Contributor), Network Science 1st Edition, Cambridge University Press; 1 edition 2016, ISBN:978-1107076266.
2. Borgatti, Stephen P., Martin G. Everett, and Jeffrey C. Johnson, Analyzing social networks. SAGE Publications Limited, 2013,ISBN-13: 978-1446247419.
3. Charu C. Aggarwal, Social Network Data Analytics, Springer; 2011 edition (1 October 2014), ISBN: 978-1489988935.

17CS3075 MACHINE LEARNING TECHNIQUES

Credits: 3:0:0

Course Objectives:

Enable the student to

- understand the concepts of machine learning.
- appreciate supervised and unsupervised learning and their applications.
- understand the theoretical and practical aspects of Probabilistic Graphical Models.
- appreciate the concepts and algorithms of reinforcement learning.
- learn aspects of computational learning theory.

Course Outcomes:
The student will be able to

- define various methods and learning techniques in machine learning.
- identify the choice of using an available tool for different machine learning techniques.
- apply probabilistic discriminative and generative algorithms for an application.
- experiment different clustering algorithms on various applications.
- design and implement probabilistic graphical
- choose the right model for various real time applications.

Unit I - Machine Learning: Machine Learning Foundations - Overview - applications - Types of machine learning - basic concepts in machine learning Examples of Machine Learning - Applications - Linear Models for Regression - Linear Basis Function Models - The Bias-Variance Decomposition - Bayesian Linear Regression - Bayesian Model Comparison.
Unit II - Supervised Learning: Linear Models for Classification - Discriminate Functions -Probabilistic Generative Models - Probabilistic Discriminative Models - Bayesian Logistic Regression - Decision Trees - Classification Trees- Regression Trees - Pruning. Neural Networks - Feed-forward Network Functions - Error Back propagation Regularization - Mixture Density and Bayesian Neural Networks - Kernel Methods - Dual Representations - Radial Basis Function Networks - Ensemble methods - Bagging - Boosting.
Unit III - Unsupervised Learning: Clustering - K-means - EM - Mixtures of Gaussians - The EM Algorithm in General - Model selection for latent variable models - high-dimensional spaces - The Curse of Dimensionality - Dimensionality Reduction - Factor analysis - Principal Component Analysis - Probabilistic PCA - Independent components analysis.
Unit IV -Probabilistic graphical models: Directed Graphical Models - Bayesian Networks - Exploiting Independence Properties - From Distributions to Graphs - Examples - Markov Random Fields - Inference in Graphical Models - Learning - Naive Bayes classifiers - Markov Models - Hidden Markov Models - Inference - Learning - Generalization - Undirected graphical models - Markov random fields - Conditional independence properties - Parameterization of MRFs - Examples - Learning - Conditional random fields (CRFs) - Structural SVMs.
Unit V -Advanced learning: Sampling - Basic sampling methods - Monte Carlo - Reinforcement Learning - K-Armed Bandit- Elements - Model Based Learning - Value Iteration - Policy Iteration. Temporal Difference Learning - Exploration Strategies - Deterministic and Non-deterministic Rewards and Actions - Eligibility Traces - Generalization- Partially Observable States - The Setting - Example - Semi Supervised Learning - Computational Learning Theory - Mistake bound analysis - Sample complexity analysis - VC dimension-Occam learning - Accuracy and confidence boosting .

Reference Books:

1. Kevin P. Murphy, Machine Learning: A Probabilistic Perspective, MIT Press, 2012, ISBN: 978-0262018029.
2. Christopher Bishop, Pattern Recognition and Machine Learning, Springer, 2006, ISBN: 978-0387310732.
3. Ethem Alpaydin, Introduction to Machine Learning, Prentice Hall of India, 2005, ISBN: 978-0262012119.
4. Tom Mitchell, Machine Learning, McGraw-Hill, 1997, ISBN: 978-1259096952.
5. Hastie, Tibshirani, Friedman, The Elements of Statistical Learning (2nd ed)., Springer, 2008, ISBN: B00475AS2E.
6. Stephen Marsland, Machine Learning –An Algorithmic Perspective, CRC Press, 2009, ISBN: 978-1466583283.

17CS3076 BINARY AND MALWARE ANALYSIS

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the basics concepts of compilers and program execution.
- recognize the behaviour of different Malwares.
- effectively engineer and reverse engineer a Malware.

Course Outcomes:

The student will be able to

- identify the static and dynamic analysis procedures with relevant debugging methods.
- describe the malware behavior and recognize the anti-reverse engineering techniques which prevent the identification of malware.
- use the malware analysis tools like ClamAV, Yara, PEiD, IDA and BinDiff to identify the malware attacks.
- analyze the self-modifying binary malwares.
- synthesize the malware samples by using Honeypots and Sandboxes.
- explain the various malware attacks by using the malware forensic tools.

Unit I - Introduction to Malware Analysis: Basic static analysis - Basic dynamic analysis - Malware analysis and virtual machines - Advanced static analysis: x86 assembly - IDA Pro - Recognizing C code constructs in assembly - Analyzing malicious windows programs - Advanced dynamic analysis: Debugging - OllyDbg - kernel debugging with WinDbg.

Unit II - Malware functionality and Anti-reverse engineering techniques: Malware Behaviour -Covert Malware Launching - Data Encoding - Malware - Focused Network Signatures - 64bit Malware Anti - reverse engineering**:** Anti-Disassembly - Anti-Debugging - Anti - Virtual Machine Techniques - Packers and Unpacking - Shell code analysis - C++ analysis.

Unit III - Malware classification: Examining Existing ClamAV Signatures - creating a Custom ClamAV Database - Converting ClamAV Signatures to YARA - Identifying Packers with YARA and PEiD - Detecting Malware Capabilities with YARA - Python: File Type Identification and Hashing - writing a Multiple - AV Scanner - Detecting Malicious PE Files -ssdeep: Finding Similar Malware - Detecting Self - Modifying Code Comparing Binaries with IDA and BinDiff.

Unit IV - Honeypots and Sandboxes: Collecting Malware Samples using Dionaea and Nepenthes -Real - Time Attack Monitoring - Real-time Event Notification and Binary Sharing
with XMPP - Analysing and Replaying Attacks - Passive Identification of Remote Systems –
Graphing Dionaea Attack Patterns with SQLite and Gnuplot. Python: Database-Enabled Multi –
AV Uploader - Accepting Nepenthes Submissions over HTTP - Accepting Dionaea Submissions over HTTP. Sandboxes: Scanning files with VirusTotal - Jotti - NoVirusThanks - Analyzing Malware using ThreatExpert - CWSandbox - Anubis - Joebox: Writing AutoIT Scripts - Defeating Path - dependent Malware - Defeating Process - dependent DLLs - Setting an Active HTTP Proxy. Scanning for Artifacts with Sandbox Results.

Unit V - Malware Forensics: TSK: Discovering Alternate Data Streams - Detecting Hidden Files and Directories - Finding Hidden Registry Data - Bypassing Poison Ivy's Locked Files - Bypassing Conficker's File System ACL Restrictions - Scanning for Rootkits with GMER -Detecting HTML Injection - Registry Forensics - Detecting Rogue-Installed PKI Certificates - Examining Malware that Leaks Data into the Registry - Debugging Malware - De-Obfuscation

Reference Books:

1. Michael Sikorski, Andrew Honig, Practical Malware Analysis - The Hands-On Guide to Dissecting Malicious Software, 2013, ISBN-13: 978-1-59327-290-6.
2. Michael Ligh, Steven Adair, Blake Hartstein, Matthew Richard, Malware Analyst′s Cookbook and DVD: Tools and Techniques for Fighting Malicious Code, 2010, John Wiley & Sons, ISBN: 978-0-470-61303-0.
3. Randal E. Bryant, David R. O'Hallaron, Computer Systems: A Programmer's Perspective, 3rd Edition, Pearson, 2010, ISBN-13: 978-0136108047.
4. Jon Erickson, Hacking: The Art of Exploitation, 2nd Edition, 2008, ISBN-13: 978-1-59327-144-2.
5. Flemming Nielson (Author), Hanne R. Nielson (Author), Chris Hankin, Principles of Program Analysis, 2010, Springer, ISBN-13: 978-3642084744.
6. Jack Koziol (Author), David Litchfield (Author), Dave Aitel, Chris Anley, Sinan "noir" Eren, Neel Mehta, Riley Hassell, The Shellcoder's Handbook: Discovering and Exploiting Security Holes, John Wiley & Sons, 2004, ISBN: 978-0764544682.
7. Ed Skoudis, Tom Liston, Counter Hack Reloaded: A Step-by-Step Guide to Computer Attacks and Effective Defenses, 2nd Edition, Prentice Hall, ISBN-13: 978-0-13-148104-6.

8. Eldad Eilam, Reversing: Secrets of Reverse Engineering, John Wiley & Sons, 2005, ISBN: 978-0-764-57481-8.

17CS3077 INTERNET OF THINGS

Credits: 3:0:0

Course Objectives:
Enable the student to
- learn Internet of Things principles and prototyping concepts.
- design internet of Things products.
- familiarize with Internet of Things applications.

Course Outcomes:
The student will be able to
- describe the working principles of internet of things.
- convert the principles into to a working prototype.
- interpret the prototype into real life working models.
- illustrate IOT business models.
- design IOT based smart applications.
- relate IOT applications to solve problems of humanity

Unit I - The Internet of Things: An Overview
The Technology of Internet of Things - Design Principles for Connected Devices - Internet Communications Overview - IP Address - MAC Addresses - TCP and UDP Ports - application Layer Protocols
Unit II - Prototyping Principles
Sketching - Familiarity - Cost versus Ease of Prototyping - Prototypes and Production - Open source versus closed source
Unit III - Prototyping Hardware
Prototyping embedded devices - Prototyping the Physical Design - Prototyping Online Component
Unit IV - Prototyping to Reality
Business Models History - The Business model canvas - Models - Funding an Internet of Things Startup -Moving to Manufacture - Designing Kits - Printed circuit boards - Scaling up Software - Ethics
Unit V - IOT Applications
Smart monitoring and Diagnostics Systems at Major Power Plants - Smart Factory - Intelligent Lot Tracking - Cleaning services Industry and Technology - Global coin chain Management - LHCb Experiment at CERN - Connected Vehicles - Smart city

Reference Books:
1. McEwen, Adrian, and Hakim Cassimally. "Designing the internet of things". John Wiley & Sons, 2013.
2. Slama, Dirk, et al. "Enterprise IoT: Strategies and Best Practices for Connected Products and Services", O'Reilly Media, Inc., 2015.
3. Bahga, Arshdeep, and Vijay Madisetti. "Internet of Things: A Hands-on Approach," VPT, 2014.
4. Greengard, Samuel. "The Internet of things. MIT Press," 2015.

17CS3078 BIG DATA PLATFORMS

Credits: 3:0:0

Course Objectives:
Enable the student to
- understand the basic concepts of big data, its characteristics and applications
- experiment with NoSQL databases
- design applications with HDFS and MapReduce components

Course Outcomes:
The student will be able to
- describe the big data concepts, sources, phases and characteristics
- classify various NoSQL databases

- use the appropriate NoSQL database for the corresponding application
- illustrate the different eco system components of Hadoop
- develop application using MongoDB, Cassandra and Hbase
- justify the need of using Hadoop framework for big data analytics

Unit I - Basic Concepts in Big Data: Types of Digital Data - Introduction to Big Data - Big Data Analytics.
Unit II - NoSQL Databases: NoSQL - Types of NoSQL - Need for NoSQL - Advantages - Limitations - Vendors - SQL vs NoSQL - NewSQL - Aggregate Data Models - More Details on Data Models - Distribution Models - Consistency.
Unit III - Document and Graph Databases: Document Database - Features - Suitable Use Cases - When not to Use - MongoDB - Need for MongoDB - Terms used in RDBMS and MongoDB - Data Types in MongoDB - MongoDB Query Language - Graph Database - Features - Suitable Use Cases - When not to Use.
Unit IV - Column- Family Databases: Column-Family Stores - Features - Suitable Use Cases - When not to Use - Introduction to Cassandra - Features - CQL Data Types - CQLSH - Keyspaces - CRUD - Collections - Alter Commands - Import and Export - Hbase - Introduction - The Basics - Architecture.
Unit V - Hadoop Framework: Introduction to Hadoop - Features - Key Advantages - Distributors - Need for Hadoop - RDBMS vs Hadoop - Distributed Computing Challenges - History of Hadoop - Overview - Use Cases - HDFS - Processing Data with Hadoop - Managing Resources and Applications with YARN - Interacting with Hadoop Eco System - MapReduce Programming - Introduction - Mapper - Reducer - Combiner - Partition - Searching - Sorting - Compression- How MapReduce Works - MapReduce Types and Formats - MapReduce Features.

Reference Books:

1. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley India, 2015. ISBN: 978 -81-265-5478-2.
2. Pramod J. Sadalage and Martin fowler, "NoSQL: A Brief Guide to the Emerging World,2013. ISBN: 978-81-317-7569-1.
3. Tom White,"Hadoop:The Definitive Guide" , O'Reilly Media, Second Edition Revised & Updated, 2011. ISBN: 978-93-5023-127-2
4. Kristina Chodorow, "MongoDB: The Definitive Guide", O'Reilly Media, Second Edition, 2013. *ISBN*: 978-1-4493-4468-9
5. Lars George, "HBase: The Definitive Guide", O'Reilly Media, 2011. ISBN: 978-93-5023-503-4
6. Chuck Lam, "Hadoop in Action", Manning Publications Co, 2011. ISBN: 978-81-7722-813-7.

17CS3079 HIGH PERFORMANCE NETWORKS

Credits: 3:0:0

Course Objectives:
Enable the student to

- generate a comprehensive understanding of network architectures, protocols, control, performance, and economies
- appraise the mathematics behind Circuit Switched Networks, Datagram networks and Asynchronous Transfer Mode Networks
- explain the convergence of the telephone, computer networking, cable TV, and wireless networks that explains current and emerging networking technologies.

Course Outcomes:
The student will be able to

- describe Packet switched networks, circuit switched networks, Internet and TCP / IP Networks.
- translate Packet switched networks, circuit switched networks, Internet and TCP / IP Networks to wireless networks.
- use the ATM and optical network.
- analyze the various switching techniques.
- combine wireless network, control networks and Switching techniques.
- evaluate Wireless Network and the mathematical background.

Unit I - Packet switched Networks & Internet and TCP/IP Networks: OSI and IP models - The Internet - Overview of Internet Protocols - Internet Protocol - TCP and UDP, Internet Success and Limitation - Performance of TCP/IP Network - Circuit Switched Networks: Performance of Circuit Switched Networks.
Unit II - SONET & ATM: SONET - Dense Wave Division Multiplexing (DWDM), Fiber to the Home - Digital Subscriber Line (DSL) - Intelligent Networks - ATM - Main Features of ATM - Addressing Signaling and Routing - Header Structure - ATM Adaptation layer - Management and Control - BISDN & Internetworking with ATM.
Unit III - Wireless Networks & Control of Networks: Link level design - Channel access - Network design - Wireless Networks Today - Future Systems and standards - Control of Networks - Objectives and methods of control - Circuit Switched Networks - Datagram networks, ATM Networks.
Unit IV - Mathematical Background: Markov Chains, Circuit Switched Networks - Datagram networks - ATM Networks - Optical Networks: Optical Links - WDM Systems & Optical Cross Connects - Optical LANs - Optical paths and Networks.
Unit V - Switching: Switch Performance Measures, Time and Space Division Switching - Modular Switch Designs - Packet Switching - Distributed Buffer - Shared Buffer - Output Buffer, Input Buffer - Global Multimedia Network: Attributes of the Global - Network Technology areas Challenges

Reference Books:

4. Walrand. J. Varaiya, High Performance Communication Network, Morgan Kaufmann- Harcourt Asia Pvt., Ltd., 2nd Edition, 2000, ISBN-10: 15-5860-574-6.
5. Behrouz A. Forouza n, TCP/IP Protocol Suite, Tata McGraw Hill, Fourth Edition, 2009. ISBN-13: 978-0073376042.
6. J.F.Kurose and K.W. Ross, Computer Networking-A top-down approach featuring the internet, Addison Wesley, 6th Edition, 2012, ISBN-13: 978-0132856201.
7. William Stallings, ISDN and Broadband ISDN with frame Relay and ATM, Pearson Education, 4th Edition, 2009, ISBN-13: 978-0139737442.
8. Rainer Handel, Manfred N. Huber, Steffen Schroeder, ATM Networks, Concepts, Protocols Applications, Pearson Education, 3rd Edition, 2009, ISBN-10: 8177585290.

17CS3080 ENTERPRISE SERVICE ORIENTED ARCHITECTURE

Credits: 3:0:0

Course Objectives:
Enable the student to

- understand the concepts of enterprise service-oriented architecture
- develop enterprise service and enterprise service-based consumer application
- Configure an enterprise service-based scenarios

Course Outcomes:
The student will be able to

- describe the concepts of enterprise service oriented architecture
- classify the various enterprise services
- illustrate configuration scenario of enterprise services using the SOA management
- model enterprise service and enterprise service-based consumer application
- develop services and consumer applications using SAP development tools
- compare the various standards for service-oriented architectures

Unit I - Introduction to Enterprise Service-Oriented Architecture: Definition of Enterprise SOA - Enterprise SOA from the Perspective of Business Processes - Enterprise SOA: A Technical Perspective - The Building Blocks of SOA Middleware - SOA Middleware for all Types of Applications - Different Entry Points, One Integration Platform - Building Blocks of SAP SOA Middleware.
Unit II - Model-Driven Business Process Development: Specification - Design - Implementation Phase - Example of a Modeling Process - Components of SOA Middleware - ES Repository - Development Environment and Tools - Services Registry - Integration Server.
Unit III - Interaction Models for SOA Middleware: Fundamental Paradigm and Processing Flow - Asynchronous Scenarios - Synchronous Scenarios - Developing an Enterprise Service - Modeling a Service Interface - Service Implementation - Classifying and Publishing a Service.

Unit IV - Developing an Enterprise Service-Based Consumer Application: Challenges in Developing a Consumer Application - SOA Middleware's Solutions for these Challenges - Overview of the Development Process - Developing a Consumer Application with SAP Development Tools.
Unit V - Configuring an Enterprise Service-Based Scenario: Overview of the Fundamental Concepts - Integrated Configuration of a Scenario Using the SOA Management Cockpit - Outlook: The Cross-System Configuration of a Scenario - Standards for Service-Oriented Architectures.

Reference Books:

1. Timm Falter, Thomas Fiedler, Martin Huvar, and Alexander Zubev, Developing Applications With Enterprise SOA, First Edition, SAP PRESS, 2008, ISBN-13: 978-1592291786.
2. James McGovern, Oliver Sims, Ashish Jain, Mark Little, Enterprise Service Oriented Architectures: Concepts, Challenges, Recommendations, First Edition, Vieweg Springer, 2006, ISBN-13: 978-1402037047.
3. Dan Woods, Thomas Mattern, Enterprise SOA: Designing IT for Business Innovation, First Edition, O'Reilly Media, 2006, ISBN-13: 9788184041446.

17CS3081 INTERET OF THINGS LAB

Credits: 0:0:2

Course Objectives:
Enable the student to

- develop Internet of Things based solutions for societal needs
- impart hands on experience on interconnecting things and internet
- develop knowledge on integration of IOT with Cloud

Course Outcomes:
The student will be able to

- describe the implementation basic IOT Architecture
- classify various sensors and actuators and its working
- apply the IOT architectural knowledge to develop IOT based solutions for societal needs
- experiment the IOT unit on real world test cases
- construct a Cloud based IOT system
- combine IOT and Cloud based applications to Fog Computing

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HoD / Director and notify it at the beginning of each semester.

17CS3931 RESEARCH PAPER WRITING SKILLS

Credits: 0:0:1

Course Objectives:
Enable the student to

- Collect and understand the technical content of research papers
- Review the literatures and infer the limitations / shortcomings
- Enrich his/her technical paper writing skills.

Course Outcomes:
The student will be able to

- outline the concepts, methodology and the outcome of research papers
- explain the problem statement based on the literatures
- solve the problem by framing appropriate methodology/framework
- experiment the methodology/framework using appropriate tools
- summarize the findings of the research work
- interpret the result and conclude by technical writing

The faculty conducting the laboratory will prepare a list of 6 experiments and get the approval of HoD/Director and notify it at the beginning of each semester.

LIST OF COURSES

Course Code	Name of the Course		Credits
15CS3007	Big Data Platforms		3:0:0
15CS3008	Algorithmic Foundations of Data Science		3:0:0
16CS1001	Computational Thinking and Programming		3:0:1
16CS2001	Essentials of Programming		3:0:0
	REVISED VERSION COURSES		
Course Code	**Version**	**Name of the Course**	**Credits**
14CS2063	1.1	Mobile Application Development Using Android	3:0:0

15CS3007 BIG DATA PLATFORMS

Credits: 3:0:0

Objective:

- To cover concepts about Hadoop framework, MapReduce framework, programming model, data formats and the Hadoop Distributed File system architecture(HDFS)
- To impart knowledge on analytics platforms built on HDFS and Mapreduce

Outcome:

The Student will be able to

- build aggregate data models to manage data storage
- design, develop and implement a mapreduce application in hadoop framework

Course Description:

Introduction to Big Data – Characteristics , Evolution and Challenges of Big Data – Why NoSQL – Data Models – CAP Theorem – Key-Value Databases – Introduction to Hadoop – The Building Blocks of Hadoop, MapReduce – The Hadoop Distributed File System – How MapReduce Works – MapReduce Types and Formats – MapReduce Features – Document Databases – MongoDB: Introduction – Creating, Updating and Deleting Documents – Querying, Column-Family Stores : Hbase – Introduction – Architecture

Reference Books:

1. Tom White,"Hadoop:The Definitive Guide" , O'Reilly Media, Second Edition Revised & Updated, 2011
2. Kristina Chodorow, "MongoDB: The Definitive Guide", O'Reilly Media, Second Edition, 2013
3. Lars George, "HBase: The Definitive Guide", O'Reilly Media, 2011
4. Chuck Lam, "Hadoop in Action", Manning Publications Co, 2011
5. Pramod J. Sadalage and Martin fowler, "NoSQL: A Brief Guide to the Emerging World of Polyglot Persistence Distilled", Pearson Education, 2013
6. Seema Acharya and Subhashini Chellappan, "Big Data and Analytics", Wiley India, 2015

15CS3008 ALGORITHMIC FOUNDATIONS OF DATA SCIENCE

Credits: 3:0:0

Objective:

- To introduce relevant mathematical and algorithmic ideas that are fundamental to the data science domain.
- To introduce concepts of randomized algorithms.

Outcome:
The student will be able to

- Mathematically prove as well as demonstrate the working of many algorithms used in the data science domain.
- Understand, design and develop algorithms to solve problems dealing with huge datasets.

Course Description:
Randomized algorithms – Introduction – Moments and Deviations – Tail Inequalities – The Probabilistic Method – Markov Chains and Random Walks.
Data Centric Problems and Algorithms -- Streaming and Sketching – Flajolet-Martin Sketch – Bloom Filters - Pairwise Independence - Universal Hashing - Perfect Hashing - Count-min Sketches - Heavy Hitters – Reservoir Sampling - **Property Testing** - Introduction – Enforce and Test approach – Regularity lemma, Local-search algorithms - PAC learning and VC-dimension.

Reference Books:

1. John Hopcroft and Ravindran Kannan, "Foundations of Data Science", 2011
2. Michael Mitzenmacher and Eli Upfal, "Probability and Computing: Randomized Algorithms and Probabilistic Analysis", Cambridge University Press, 2005.
3. Rajeev Motwani and PrabhakarRaghavan, "Randomized algorithms", Cambridge University press, 1995.
4. Dana Ron, "Algorithmic and Analysis Techniques in Property Testing", Now Publishers Inc, 2010.

16CS1001 COMPUTATIONAL THINKING AND PROGRAMMING

Credits: 3:0:1

Objective:
Enable the student to

- understand the foundational concepts of computational thinking and logical literacy
- apply algorithmic thinking in problem solving.
- consider real life problems in a broad range of domains and impact of computing on society.

Outcome:
The student will be able to

- visualize and analyze different type of data.
- apply computational thinking for solving real-world problems.
- develop algorithms and convert them to code using a programming language.
- understand the impact of computing, data security and privacy in Internet.

Social Media and Personal Data Analytics, Crisis Response using Data and Information, Forms of Data, Data Encoding, Number Systems, Encoding Schemes, Compression, Collection, Analysis; **Solving Puzzles and Digital Displays** using Logical Thinking and Reasoning, Boolean Logic; **Search Engine Queries and Database Queries** using Propositional Logic; **Google Maps and Project Loon** using Problem Solving and Computational Thinking, Problem Definition, Problem Decomposition, Logical Reasoning, Abstraction; **Path Finding in a Maze and Travelling Salesperson** using Algorithmic Thinking, Algorithm Design, Flowcharts, Debugging; **Mobile Apps (Gaming Apps)** using Programming: Name Binding, Decision Making, Iteration; **Computer Graphics (Fractals)** using Modularization, Recursion; **Search Engines, DNA Matching and Address Books** using Text Processing, Pattern Matching, Algorithmic Techniques: Searching, Sorting; **Autonomous Cars and Speech Recognition (Siri, Cortana, Google Now)** using Digital media, Images, Sound; **Social Media Photo Sharing and Photo tagging** using Internet and Multimedia, Security and Privacy in the Internet.

References:

1. Paul S. Wang, "From Computing to Computational Thinking", Chapman and Hall/CRC; Nil edition (1 October 2015), ISBN-10: 1482217651, ISBN-13: 978-1482217650.
2. David D. Riley, Kenny A. Hunt, "Computational Thinking for the Modern Problem Solver (Chapman & Hall/CRC Textbooks in Computing)", Chapman and Hall/CRC; 1st edition (27 March 2014), ASIN**:** B00IZL9NQI.
3. Harry Gensler, "Introduction to Logic", 2nd edition, Routledge Press, 2010, ISBN: 0415996511.
4. Brandon Milonovich, "Scratch Cookbook", Packt Publishing (July 24, 2013), ISBN-10: 1849518424.
5. Allen B. Downey, "Think Python: How to Think Like a Computer Scientist", 2nd Edition, O'Reilly Media, Inc., 2015, ISBN: 1491939419, 9781491939413.
6. Charles Dierbach , "Introduction to Computer Science Using Python : A Computational Problem - Solving Focus", Wiley India Pvt. Ltd, June 2015, ISBN-10: 8126556013.

16CS2001 ESSENTIALS OF PROGRAMMING

Credits: 3:0:0

Objectives:

- To define the basic concepts of programming
- To learn and apply the appropriate methodology for problem solving through programming.
- To design and develop solutions for problems using C programming.

Outcome:

Students will be able to

- Define the basics of programming.
- Apply the appropriate methodology for solving problems using programming
- Design and develop efficient solutions for problems using C programming.

Introductory concepts, Information Technology and Internet, Problem Solving Techniques, Introduction to C Programming, Operators and expressions, Data Input and Output, Preparing and running a complete program, Control Statements, Functions, Program Structure, Arrays, Strings, Pointers, Structure and Unions, File Handling. Bitwise Operations, Enumerations, Command Line Parameters, Macros, C Preprocessor.

Reference Books:

1. Byron S Gottfried, Jitender Kumar Chhabra, "Programming with C (Schaum's Outlines Series)", Third Edition, Tata McGraw Hill, 2011, ISBN: 9780070145900.
2. Ashok N. Kamthane. "Computer Programming", Second Edition, Pearson Publications, New Delhi, 2012, ISBN: 978-81-317-6494-7.
3. Herbert Schildt, "The Complete Reference C", Fourth Edition, McGraw-Hill Publications, 2007, ISBN: 978-0072121247.
4. Yashwant kanetkar, "Let us C", 10th Edition, BPB Publications,2010, ISBN: 978-81-8333-163-0.
5. Kashi Nath Dey, Samir Bandyopadhyay, "C Programming Essentials", 2010, Dorling Kindersley (India) Pvt. Ltd., ISBN: 978-81-317-2889-5.
6. Anita Goel, Ajay Mittal, "Computer Fundamentals and Programming in C", 2013, Dorling Kindersley (India) Pvt. Ltd., ISBN: 978-93-325-1934-3.
7. E.Balagurusamy, "Programming in ANSI C", Sixth Edition, Tata McGraw Hill, 2012, ISBN: 978-1-25-900461-2.

14CS2063 MOBILE APPLICATION DEVELOPMENT USING ANDROID

Credits : 3:1:0 **(Version 1.1)**
Prerequisite: 14CS2040 Programming in Java

Objective:
The student will be able to

- understand the platform, tools, technology and process for developing mobile applications using Google Android
- demonstrate the operation of the application, application lifecycle, configuration files, intents and activities
- secure, tune, package, deploy and manage Android applications

Outcome:
The student will be able to

- identify a significant programming component, involving the sensors and hardware features of mobile device
- design and develop android applications for real time problems
- deploy and publish mobile application on the cloud

Introduction – Android Architecture - Android SDK Features – Development Framework – Basics of Android Application – Android Development Tools – Creating Applications and Activities – Creating User Interfaces – Intents, Broadcast Receivers, Adapters and Internet - Files and Saving Activity State – Databases and Content Providers – Maps, Geocoding and Location-Based Services - Services, Thread and Notifications - Native Hardware Access - Multimedia in Android - Telephony and SMS – Network Connectivity - Deploying Apps on the cloud.

Reference Books:

1. Dawn Griffiths, David Griffiths, Head First Android Development, First edition, O'Reilly, 2015, ISBN: 1449362184.
2. Paul Deitel, Harvey Deitel, Alexander Wald, Android 6 for Programmers: An App-Driven Approach, Third edition, Prentice Hall, 2015, ISBN: 0134289366.
3. Joseph Annuzzi, Lauren Darcey, Shane Conder, Introduction to Android Application Development: Android Essentials, Fifth edition, 2015, Addison-Wesley Professional, ISBN: 9780134389455.
4. Anubhav Pradhan, Anil V. Deshpande, Composing Mobile Apps: Learn, Explore, Apply using Android, First Edition, Wiley India Pvt Ltd, 2014, ISBN 9788126546602.
5. Reto Meier, Professional Android 4 Application Development, Third edition, Wrox, 2012, ISBN 978-1118102275.
6. Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, Programming Android, Second Edition, O'Reilly Media, 2012, ISBN 978-1449316648.

LIST OF SUBJECTS

Sub. Code	Name of the Subject	Credits
14CS3083	Machine Vision and Image Processing	3:0:0
15CS2001	iOS Programming	3:1:0
15CS2002	iOS Programming Lab	0:0:2
15CS2003	Web Development using JavaScript	3:1:0
15CS2004	Hadoop Programming	3:0:0
15CS2005	Hadoop Programming Lab	0:0:2
15CS2006	Web Programming for Biological Applications	3:0:0
15CS2007	Database Management System for Biological Application	3:0:0
15CS3001	Ethical Hacking	3:0:0
15CS3002	PERL Programming for Biological Applications	3:0:0
15CS3003	PERL Programming for Biological Applications Lab	0:0:2
15CS3004	Data Mining and Warehousing for Bioinformatics	3:0:0
15CS3005	Python Programming for Bioinformatics	3:0:0
15CS3006	Python Programming for Bioinformatics Lab	0:0:2

REVISED VERSION SUBJECTS			
Sub. Code	**Version**	**Name of the Subject**	**Credits**
14CS2002	1.1	Business Intelligence	3:0:0
14CS2007	1.1	Computer Networks	3:0:0
14CS2008	1.1	Cryptography and Network Security	3:0:0
14CS2011	1.1	Database Systems	3:0:0
14CS2018	1.1	Ethics in Information Technology	3:0:0
14CS2035	1.1	Object oriented programming in C++	3:0:0
14CS2040	1.1	Programming in Java	3:0:0
14CS2050	1.1	Unix Architecture	3:0:0
14CS2052	1.1	Web Technology	3:0:0
14CS2054	1.1	C# and .NET Programming	3:1:0
14CS2057	1.1	Programming in J2EE	3:1:0
14CS3005	1.1	Advanced Database Systems	3:0:0
14CS3006	1.1	Advanced Operating System	3:0:0
14CS3011	1.1	Cloud Computing Services	3:0:0
14CS3013	1.1	MPLS and VPN	3:0:0
14CS3037	1.1	Requirements Engineering	3:0:0
14CS3041	1.1	Software Metrics and Quality Management	3:0:0
14CS3042	1.1	Software Project Management	3:0:0
14CS3054	1.1	Database Security	3:0:0
14CS3059	1.1	Web Services	3:0:0
14CS3064	1.1	Network Security	3:0:0
14CS3071	1.1	Pervasive Computing	3:0:0

14CS3083 MACHINE VISION AND IMAGE PROCESSING

Credits: 3:0:0

Course Objective:

- To enable the students to understand the application areas, restrictions and structure of machine vision systems.
- To understand and apply the basic concepts of optics in imaging.
- To learn the various hardware components of an imaging system for machine vision applications.

Course Outcome:

The Students will be able to

- Understand and apply a series of probabilistic models of images and objects in machine vision systems.
- Improve the quality of the image through image processing
- Analyze the image through machine vision techniques.

Vision types – Block diagram and function of machine vision – implementation, Justification and limitations. Scene constraints, Lighting sources, parameters and techniques, Lenses and Optical Filters - Specifications and Selection, imaging Sensors, Interfaces, Geometrical Image formation models – Camera Calibration. Machine vision applications, Case studies. Machine Vision for intelligent and service robots- Vision based navigation, calibration, free manipulation. Machine Vision Software, Image Acquisition Modes – Image Processing in spatial and frequency domain, Feature extraction – Region, Shape and Size features - Texture Analysis– 3D Machine Vision Techniques – Decision Making.

Reference Books:

1. Ramesh Jain, Rangachar Kasturi, Brian G. Schunck, "Machine Vision", Mc Graw-Hill Publishers, First Edition, 2001.
2. Rafael C.Gonzales, Richard.E.Woods, "Digital Image Processing" Prentice Hall Publishers, Third Edition, 2007.
3. Alexander Hornberg, "Handbook of Machine Vision", Wiley-VCH Publishers, First Edition, 2006.
4. Eugene Hecht, A.R. Ganesan, "Optics", Addison-Wesley Publishers, Fourth Edition, 2001.
5. Emanuele Trucco, Alessandro Verri, "Introductory Techniques For 3D Computer Vision", Prentice Hall Publishers, First Edition, 1998.

15CS2001 iOS PROGRAMMING

Credits 3:1:0

Objective:

- To write simple programs using objective-C language
- To develop apps for iPhone, iPad by using Xcode
- To use Cocoa Touch Frameworks
- To access built-in applications, persist data and use web services
- To test the applications on the simulator and on a actual device

Outcome:

The student will be able to

- Develop a database driven application
- Integrate location services into an application
- Design and develop apps for latest iOS platform to Apple standards

Introduction to Objective-C , Classes, Objects & Methods, Data Types, Control Statements, Inheritance, Dynamic typing and binding, Categories & protocols, Foundation Framework – introduction, Numbers, Strings, Collections, working with Files, Memory Management, Copying Objects, Archiving, Cocoa, Cocoa Touch and the iOS SDK - introduction, create a simple iOS application-Creating a personal Library, TableViews, Map Kit, Action Views and Alerts, Internationalization, Multimedia, Web services and Parsing, FTP, Implementing Core Data, Notifications, Email, SMS, Dialing a phone, address book, event programming, Integrating with social media

Reference Books:

1. Peter Van de Put, Professional iOS Programming, 2014,John Wiley and Sons, ISBN: 978-1-118-66113-0
2. Stephen G. Kochan, Programming in Objective-C, Third Edition, Addison-Wesley, 2011, ISBN 978-0-321-71139-7
3. Dan Pilone, Head First iPhone and iPad Development, 2013, O'Reilly, ISBN : 978-9351104254

15CS2002 iOS PROGRAMMING LAB

Co-requisite:15CS2001 iOS Programming

Credits: 0:0:2

Objective:

- To learn the platform, tools, technology and process for developing applications with Apple iOS.
- To get exposure about MVC, Cocoa Frameworks
- To develop apps for iPhone, iPad by using Xcode , Cocoa Touch Frameworks

Outcome:

The student will be able to

- use the latest iOS SDK, Xcode, and the Objective-C programming language to build iOS applications.
- use auto layout to create flexible and robust interfaces
- gain hands-on coding experience for developing applications for a mobile platform.

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The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

15CS2003 WEB DEVELOPMENT USING JAVASCRIPT

Credits 3:1:0

Objective:

- To enable rapid development of rich web applications
- To learn separation of concerns and identify the layers of the Web
- To map HTML using the DOM

Outcome:

The student will be able to

- Understand the libraries of JavaScript
- Create dynamic styles and animations on a web page
- Use regular expressions for form validations
- Use XML ,HTTP Request to exchange data with the server

Introduction to JavaScript, JavaScript using HTML, Language Basics, Variables, Scope, and Memory, Reference Types, Object - Oriented Programming, Function Expressions, Browser Object Model, client detection, Document Object Model, DOM extensions, DOM levels 2 and 3, events, scripting forms, HTML5 scripting, error handling and debugging, XML in JavaScript, ECMAscript for XML, JSON, AJAX and COMET, advanced techniques, offline applications and client - side storage, Server side JavaScript-Node.js, JSFramework - AngularJs.

Reference Books:

1. Nicholas C.Zakas, Professional Javascript for Web Developers, Third Edition, 2012, Wiley India Pvt Ltd, ISBN: 978-1-118-02669-4
2. Thomas A Powell, Fritz Schneider, Javascript: The Complete Reference, Third Edition, 2013, McGrawHill, ISBN 978-0-07-174120-0
3. Danny Goodman, Michael Morrison, Paul Novitski, Tia Gustaff Rayl, Javascript Bible, Seventh Edition, 2010, Wiley India Pvt Ltd, ISBN: 978-0-470-52691-0

15CS2004 HADOOP PROGRAMMING

Pre-requisite: 14CS2040 Programming in Java

Credits: 3:0:0

Objective:
The course objective is to impart in depth knowledge of

- Hadoop Distributed File System – HDFS
- Usage of Map Reduce.
- Managing and Monitoring Hadoop Cluster.
- Importing and exporting data using Sqoop.
- Utilizing Hive & Pig for analysis

Outcome:
The student will be able to

- Get a clear understanding of Apache Hadoop, HDFS, Hadoop Cluster and Hadoop Administration.
- Plan and Deploy a Hadoop Cluster.
- Load Data and Run Applications.
- Perform the installation of Pig, Hive and HBase Administration.

Introduction to Hadoop – MapReduce-The Hadoop Distributed Filesystem - Hadoop I/O-Developing a MapReduce Application – Working of MapReduce – MapReduce Types and Formats- MapReduce Features- Setting up a Hadoop Cluster- Administering Hadoop- Pig- Hive-HBase – ZooKeeper -Sqoop.

Reference Books:

1. Tom White, Hadoop : The Definitive Guide, Third Edition, O'Reilly, Shroff Publishers, 2012, ISBN 978-93-5023-756-4
2. Chris Eaton, Paul Zikopoulos, Understanding Big Data, Analytics for Enterprise Class Hadoop and Streaming Data, Mcgraw-hill, 2011, ISBN 9780071790543
3. Garry turkington, Hadoop Beginner's Guide: Learn How to Crunch Big Data to Extract Meaning from the Data Avalanche, Shroff publishers and Distributors, 2013, ISBN 978-93-5110-110-9
4. Chuck Lam, Hadoop in Action, Dreamtech Press, 2011, ISBN 8177228137
5. Alex Holmes, Hadoop in Practice, First Edition Dreamtech Press, 2013. ISBN 9351191508

15CS2005 HADOOP PROGRAMMING LAB

Co-requisite: 15CS2004 Hadoop Programming

Credits: 0:0:2

Objective:

- To impart the practical knowledge on usage of Map Reduce.
- To enable the students to manage and monitor Hadoop Cluster.
- To provide clear understanding of importing and exporting data using Sqoop.
- To enable them to utilize Hive & Pig for analysis.

Outcome:

The student will be able to

- Plan and Deploy a Hadoop Cluster.
- Load Data and Run Applications.
- Perform the installation of Pig, Hive, and HBase Administration.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

15CS2006 WEB PROGRAMMING FOR BIOLOGICAL APPLICATIONS

Credits: 3:0:0

Objectives:

- Determine the necessary system capacity to support Bio servers
- Install and administer bio servers and simulation servers
- Identify and resolve issues with server's performance

Outcome:

- Test the functioning of various bio servers
- Configure bio server administration, including hosting
- System optimization techniques for managing a server

Basics of web server and web server administration – Understanding server and web server administration - Preparing for server installation –Evaluating server components - Identifying the server categories- Managing and configuring a server – Understanding domain name service - Installing and configuring DNS in Linux - Types of web hosting plans – web hosting services and web applications, PHP Scripting, Introduction to bio servers- Simulation, Sequence and allele server. Bioclusters and supercomputing- Case study on protein structure prediction

Reference Books:

1. Steve Silva,Web Server Administration, Web Warrior Serious, 2004
2. Carl Burnhan., Web Hosting, McGraw – Hill Publisher, Fourth Edition, 2001
3. G. Alonso etal., Web Services: Concepts, Architectures and Applications, Springer, First Edition 2009
4. Jeffrey C. Jackson, Web Technologies, Pearson Publication, 2006
5. Eric Newcomer, Understanding Web Services, Addison-Wesley Professional, 2002

15CS2007 DATABASE MANAGEMENT SYSTEM FOR BIOLOGICAL APPLICATIONS

Credits: 3:0:0

Objectives:

- To explore sequence, genome, protein structure, pathway, and other commonly used databases.
- To learn about design issues related to biological databases, including issues with heterogeneity and complex data.
- Overview of the functions of the Database Management System and relational database design.

Outcome:

- To design and develop a databases for biological datasets.
- To recognize various data formats and file types.
- To develop proficiency in the use of a wide variety of biological databases and database tools.

Introduction to biological databases – Understanding and using biological databases – Classification of biological databases –Pathway database- information retrieval system – Mapping - Heterogeneity in databases - Data complexity of biological data- Difference between DBMS and RDBMS – Architecture of DBMS – Distributed databases- Structure and design of distributed databases – Data models – Entity relationship model – relational model – Object oriented database – Object relational database- Normalization – PL/SQL – PL/SQL blocks – Triggers – Packages – Oracle.

References Books:

1. Andreas D. Baxevanis, B. F. Francis Ouellette, Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, Third Edition, Wiley and Sons, 2004
2. S.C. Rastogi, N. Mendiratla, P.Rastogi, Bioinformatics Methods and Applications-Genomics, Proteomics and Drug Discovery, Prentice Hall India, 2004
3. C.J. Date, An Introduction to Database Systems, Third Edition, Narosa publishers, Reprint 1997
4. Abraham Silberschatz, Henry K Korth, Sudarshan S, Database Concepts, McGraw Hill International publications, New Delhi, Fourth Edition, 2002
5. Ramesh Elmasri, Shamkant B. Navathe, Fundamentals of Database Systems, Addison-Wesley Publications, India, Fourth Edition, 2004

15CS3001 ETHICAL HACKING

Credits 3:0:0

Objective:

- To introduce students to the fundamentals of ethical hacking
- To provide the fundamental information associated in the art of attacking computer infrastructure for the purposes of testing, auditing, and pre-emptively securing these infrastructures

Outcome:

Student will be able to:

- learn how to apply knowledge of engineering to security evaluations and design
- understand the impact of security practices in a global and societal context
- defend a computer against a variety of different types of security attacks
- practice and use safe techniques on the World Wide Web

Ethical Hacking overview – Legal and illegal operations- Footprinting and Social Engineering – social engineering attacks - scanning – enumeration – core defence mechanisms – attacking authentication – insider attacks – wireless hacking – hacking hardware – web and database hacking – mobile hacking – countermeasures

Reference Books:

1. Michael T. Simpson, Kent Backman, James Corley, Hands - On Ethical Hacking And Network Defense, Delmar Cengage Learning, 2012, ISBN-13: 978-1133935612
2. Allen Harper, Shon Harris, Gray Hat Hacking The Ethical Hackers Handbook, Third Edition, McGraw Hill Education, 2011, IBSN-13: 978-0071742559
3. Dafydd Stuttard, Marcus Pinto, The Web Application Hacker's Handbook: Finding and Exploiting Security Flaws, Second Edition, Wiley, 2011, ISBN-13: 978-1118026472.
4. Stuart Mcclure, Joel Scambray, George Kurtz, Hacking Exposed 7: Networking Security Secrets and Solutions, Seventh Edition McGraw Hill Education, 2012. ISBN-13: 978-0071780285

15CS3002 PERL PROGRAMMING FOR BIOLOGICAL APPLICATIONS

Credits: 3:0:0

Objectives:

- To learn PERL syntaxes and advantage of using PERL for a scripting tool.
- To learn to use hashes, powerful regular expression and system interface to solve commonly encountered problem.
- To learn to use modules from the standard PERL distribution.

Outcome:

- The students will be able to properly use scalars, arrays and associative arrays
- Design and use PERL regular expression.
- Setup and Communicate through a secure shell with a Linux system

Introduction to UNIX and PERL, I/O Variables, Scalar Data, Arrays, Lists, Hashes, References, Control Structures, Functions, File I/O and Debugging, Html and CGI Programming, Regular expressions, Accessing System Resources, Modules and packages , API's, HTML and CGI Programming, Sockets, Unix DBM, Generating Reports with Perl, BIOPERL package- BLAST, Fasta Genbank, BLAT.

Reference Books:

1. Randal L. Schwartz, Brian d foy, Tom Phoenix. Learning Perl, O'Reilly Media, 2011
2. Sriram Srinivasan, Advanced Perl Programming. O'Reilly Media, 2005
3. Lincoln D. Stein, Network Programming with Perl, Addison-Wesley Professional, 2001
4. David Scott, Perl for Bio Informatics – I, First Edition, San Diego, California, David Scott, 2013

15CS3003 PERL PROGRAMMING FOR BIOLOGICAL APPLICATIONS LAB

Co-requisite: 15CS3002 PERL Programming for Biological Applications

Credits: 0:0:2

Objectives:

- To enable the students to write scripts which demonstrate ability to input data to the script through pipes, keyboard input and files
- To teach how to modify and extract specific contents of files
- To equip for design and create function with and without parameters

Outcome:

- To create Perl scripts that read from files
- Students will be able to create Perl scripts that use loops, conditions, arrays, and variables
- Create Perl scripts that do pattern matching and substitutions

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD / Director and notify it at the beginning of each semester.

15CS3004 DATA MINING AND WAREHOUSING FOR BIOINFORMATICS

Credits: 3:0:0

Objectives:

- To impart various techniques developed for data mining to discover interesting patterns in Biological databases
- To Expose students to new techniques and ideas that can be used to improve the efficacy of data mining tools
- To create a clean, consistent repository of biological dataset within the data warehouse

Outcomes:

- Solve real data mining problems by using the right tools
- To find interesting patterns in protein and nucleotide sequences
- Lear the process for designing and constructing a data warehouse.

Introduction to Data Mining - data preprocessing - knowledge discovery process in data mining - data mining algorithms - association rules - classification - prediction - clustering - mining real data – chemical data mining – clinical data classification- significant role of metadata - data warehouse architecture and design -data replication and online analytical processing – data warehouse deployment – growth and maintenance- Case study on applications of data warehousing and data mining in biological and biomedical related fields

Reference Books:

1. Jiawei Han, Micheline Kamber, Datamining Concepts and Techniques, Second Edition, Morgan Kaufmann Publishers, March 2006
2. Paulraj ponniah, Data Warehousing Fundamentals,Wiley,2007
3. Inmon, W.H., Strauss, D., Neushloss., The Architecture for the Next Generation of Data Warehousing, 2008
4. Golfarelli, M., Rizzi, S., Data Warehouse Design: Modern Principles and Methodologies, McGraw-Hill, 2009
5. Rokach, L., Maimon, O., Data Mining with Decision Trees: Theory and Applications, World Scientific, 2008

15CS3005 BIOINFORMATICS PROGRAMMING IN PYTHON

Credits: 3:0:0

Objectives:

- To introduce to programming concepts and techniques and Python language syntax.
- To learn and understand programming concepts that can be applied across languages
- To learn use of advanced programming tools including Version Control, Debuggers, and Tests.

Outcome:

The students will be able

- To analyze and design strategies for solving basic programming problems.
- To use primitive data types, selection statements, loops, functions to write programs.
- To use the step-wise refinement approach.

Lists, dictionaries, list comprehensions, modules, Iterators and Generators, Functional Programming, Classes and Objects, Python Libraries, Exception Handling, Regular expressions, Data Structure and algorithm, CGI, Database, Networking, Multithreading, GUI Programming, Distributed Computing, Advanced I/O handling, Generators and Coroutines, Introduction to NumPy SciPy and Matplotlib, Building classification model, Binary and multiclass classification

Reference Books:

1. Mark Lutz, Learning Python, O'Reilly Media, Inc., 2013
2. David M. Beazley, Python Essential Reference, Addison-Wesley Professional, 2009
3. Willi Richert, Building Machine Learning Systems with Python, Packt Publishing Ltd, 2013.
4. Alex Martelli, Anna Ravenscroft, David Ascher, Python Cookbook, 'O'Reilly Media, Inc., 2005
5. Tim J. Stevens, Wayne Boucher, Python Programming for Biology: Bioinformatics and Beyond, Cambridge University Press, 2014

15CS3006 BIOINFORMATICS PROGRAMMING IN PYTHON LAB

Co-Requisite: 15CS3005 Bioinformatics Programming in Python

Credits: 0:0:2

Objectives:

- To learn to write, debug, and execute Python programs.
- To learn to use basics of modules and object oriented programming in Python and use exception handling.
- To use Python to work with files and the operating system.

Outcome:

- The students will be able to write programs using complex data types and object oriented programming code.
- Use regular expression and threads in python code.
- Create Network program and GUI in python.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD / Director and notify it at the beginning of each semester.

14CS2002 BUSINESS INTELLIGENCE (V-1.1)

Credits 3:0:0

Objective:

- To provide enhanced knowledge on business intelligence and the techniques for gathering, storing, analyzing, and Reporting.
- To impart knowledge about decision support system, online analytical processing (OLAP), statistical analysis, forecasting, and data mining.

Outcome:

The student will be able to

- apply the business intelligence process across the organization
- make predictive analytics work for your bottom line
- blend business intelligence process into daily management activities

Introduction to business intelligence - Need for business intelligence - data mart - defining business intelligence structures -package items -analyzing cube content -MDX scripting - additional dimensions –Introduction to data mining - data mining structure- mining accuracy chart -delivering: reporting services - report manager.

Reference Books:

1. Brain Larson, Delivering Business Intelligence with Microsoft SQL server 2008, McGraw Hill,2008, ISBN: 978-0071549448
2. Lynn Langit, Foundations of SQL Server 2005 Business Intelligence, Apress 2007, ISBN 978-1590598344
3. Paul Turley, Thiago Silva, Bryan C. Smith, Ken Withee , Professional Microsoft SQL Server 2008 Reporting Services , John Wiley and Sons, 2012, ISBN: 13-978-1118101117
4. Philo Janus, Guy Fouche, Pro SQL Server 2008 Analysis Services, Apress, 2010, ISBN:1430219955

14CS2007 COMPUTER NETWORKS (V-1.1)

Credits: 3:0:0

Objective:

- To introduce key trends on network principles and practices.
- To provide a top down approach which focus on the internet and its accessible styles.

Outcome:

The student will be able to

- understand the organization of computer networks, factors influencing computer network development and the reasons for having different types of networks.
- understand the internet structure and can see how standard problems are solved in that context.
- analyze network protocols and understand literature concerning computer networks.

Computer Networks and the Internet - The application layer – Principles of network Applications - The Web and HTTP - File Transfer: FTP - Electronic Mail in the Internet – DNS -P2P File Distribution - Socket Programming using TCP and UDP- The transport layer – Services - Multiplexing and Demultiplexing - Connectionless Transport: UDP -Principles of Reliable Data Transfer - Connection-Oriented Transport: TCP- The network layer – Virtual Circuit and Datagram Networks - What's Inside a Router? - The Internet Protocol (IP): Forwarding and Addressing in the Internet - Routing Algorithms - Routing in the Internet- The link layer - Error-Detection and –Correction Techniques - Multiple Access Links and Protocols- Switched Local Area Networks – Network Management

Reference Books:

1. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, sixth Edition, Addison-Wesley, 2013, ISBN-13: 9780132856201
2. William Stallings, Data and Computer Communications, Prentice Hall, Eighth Edition, 2007,ISBN9780132433105
3. Andrew S.Tanenbaum, Computer Networks, Prentice Hall of India, Fifth edition, 2010 ISBN-13: 978- 0132126953.
4. Fred Halsall, Computer Networking and the Internet, Fifth Edition, Addison-Wesley, 2005, ISBN 9780321263582
5. Kevin R. Fall, W. Richard Stevens, TCP/IP Illustrated Volume – I: The Protocols, Addison Wesley Professional Computing Series, 2011, Second Edition, ISBN-13:978-0321336316.
6. Behrouz A Forouzan, Firouz Mosharraf, Computer Networks: A Top-Down Approach, Tata McGraw Hill, 2012, ISBN-13: 978-1-25-900156-7, ISBN-10: 1-25-900156-3.

14CS2008 CRYPTOGRAPHY AND NETWORK SECURITY (V-1.1)

Credits 3:0:0

Objective

- To facilitate the students to understand the different kinds of security issues.
- To introduce the various principles of cryptosystems.
- To make the students aware of hashing algorithms and digital signatures.

Outcome:

The student will be able to

- put into practice the various symmetric and asymmetric key algorithms.
- understand the importance of network security.
- handle different kinds of attacks.

Overview of computer security – Security attacks – Services – Mechanisms - Block cipher - DES – AES -Public-key Cryptography and RSA – Key Management– Diffie–Hellman Key Exchange – ElGamal Cryptosystem - Elliptic Curve Cryptography -Secure Hash Algorithm – SHA-3 — CMAC –HMAC – Digital Signature Standard – Kerberos – X.509 Authentication Service-E-mail Security – Pretty Good Privacy – S/MIME - IP security -Transport level security -Secure Socket Layer Intruders – Firewalls-cyber crime and computer crime.

Reference Books:

1. William Stallings, Cryptography and Network Security, Fifth Edition, Prentice Hall, 2006. ISBN 13: 978-0-13-609704-4
2. Bruce Schneier, Applied Cryptography, Second Edition, John Willey and Sons, 2007. ISBN: 8126513683
3. Wenbo Mao, Modern Cryptography, First Edition, Pearson Education, 2008 ISBN: 978-81-317-0212-3
4. Roberta Bragg, Mark Rhodes, Keith Strassberg, Network Security, Tata Mcgraw Hill First Edition, 2008, ISBN-13: 978-0-07-058671-0
5. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, Second Edition, Prentice Hall, 2002, ISBN: 81-203-2213-4

14CS2011 DATABASE SYSTEMS (V-1.1)

Credits 3:0:0

Objective:

- To provide the fundamentals of relational systems including data models, database architectures, and database manipulations.
- To enable the students to create and manage database tables using SQL
- To enable the students to understand the new developments and trends in database applications

Outcome:

The student will be able to

- understand the basics of data management and administration.
- retrieve data using SQL.
- do the database design and understand the database performance issues
- evaluate the normality of a logical data model, and correct any anomalies.
- work as a valuable member of a database design and implementation team.

Introduction to Database Management Systems – ER- model, Relational model, Query Languages – SQL and Advanced SQL, Triggers, Database Design and E-R Model –Designing database for practical applications – Database System Architecture, Relational Database Design – Normal forms – Studying the impact of different normalization forms for practical applications - Modeling Temporal Data, Storage and File Structure – Sequential files, indexing, B and B+ trees - different file Transactions and concurrency control - Case Study : Implementation of different indexing techniques in DBMS – Development of a database application program.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, Sixth Edition, Mc Graw-Hill International, 2011. ISBN 9780071325226.
2. Ramez Elmasri, Fundamentals of Database Systems, Fifth Edition, Pearson Education India, 2011, ISBN 10: 8131758982
3. Garcia Molina, DataBase Systems: The Complete Book, Pearson education, 2011, ISBN 9780133002010.
4. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill Education, 2014, ISBN: 9789339213114

14CS2018 ETHICS IN INFORMATION TECHNOLOGY(V-1.1)

Credits 3:0:0

Objective:

- To understand the development and need for issues regarding social, legal, privacy and the application of computer ethics to information technology.
- To learn professional ethics, privacy, criminal conduct, property rights, free speech, access, and reliability.

Outcome:

The student will be able to

- identify issues of professional conduct in information technology.
- determine the impact of the privacy laws on information security policies.
- understand the issues related to intellectual freedom, intellectual property and copyright law as they relate to electronic publishing.
- identify key ethical concerns of information technology specialists.
- respond to and apply appropriate decisions around ethical issues in an array of information and technology practices.

An Overview of Ethics - Ethics in the Business World-Ethics in IT-Ethics for IT Workers, Users and Professionals-IT professional malpractice - IT Security Incidents - Privacy-Privacy Protection and the Law-Key Privacy and Anonymity Issues –Cybercrime and criminal Justice-Penalties, Adjudication and Appeals Under the IT Act - Intellectual Property-Copyrights-Patents-Trade Secrets-Key Intellectual Property Issues-Strategies to Engineer Quality Software-Key Issues in Software Development- the impact of IT on the Standard of Living and Productivity - the impact of IT on Healthcare Costs - Social Networking - Ethics of Information Technology Organizations -ICT Industry Code for Conduct

Reference Books:

1. Ethics in Information Technology, Fourth Edition, by George Reynolds, CENGAGE Learning ,2012,ISBN-9788131518755
2. Vivek Sood, Cyber Law Simplified, Fourth Edition by, Tata McGraw-Hill, ISBN-13:978-07-043506-3, ISBN-10:0-07-043506-5
3. Case Studies in Information Technology Ethics, Second Edition, by Richard A. Spinello, Prentice-Hall,2002.ISBN 0130991503
4. A Gift of Fire:social, legal, and ethical issues for computing and the Internet, Second Edition, by Sara Baase, Prentice Hall, 2008, ISBN 0136008488, 9780136008484
5. Tavani , Ethics and Technology: Ethical Issues in an Age of Information and Communication Technology, Second Edition, H, John Wiley and Sons 2007. ISBN: 978-0-471-99803-7

14CS2035 OBJECT ORIENTED PROGRAMMING IN C++ (V-1.1)

Credits 3:0:0

Objective:

- To teach the students how to write high quality, internally documented, well-structured C++ program.
- To enable the students to learn how C++ supports Object Oriented principles such as abstraction, information hiding, localization and modularity, and how to apply these principles in software development.

Outcome:

The student will be able to

- identify the major elements in an object-oriented programming language.
- implement operator overloading and use inheritance in C++.
- select the proper class protection mechanism.
- demonstrate the use of virtual functions to implement polymorphism.
- understand the advanced features of C++ including templates, exceptions, and multiple inheritances.

Introduction to object oriented concepts - C++ Programming Basics – Data Types – i/o statements – operators- Loops and Decisions – Debugging of Simple C++ Program – Structures - Functions - Application Development using Structure and Control Statements - Objects and Classes - Arrays and Strings – Real Time Application using Objects and Arrays - Operator Overloading- Inheritance-Pointers – Application Development using Inheritance and Polymorphism - Virtual Functions- Streams and Files- Templates and Exceptions – Real Time Application using Files, Streams and Templates with Error Handling

Reference Books:

1. Robert Lafore, Object Oriented Programming in C++, Fourth Edition, Tech Media, 2008. ISBN 0-672-32308-7.
2. Herbert Schildt, C++: The Complete Reference, Fifth Edition, Tata McGraw-Hill, 2015. ISBN 978-0071634809
3. Joyce Farrell, Object-Oriented Programming Using C++, Fourth Edition, Cengage Learning, 2013, ISBN 978-8131519431
4. Paul J. Deitel, Harvey M. Deitel, C++: How to Program, Pearson, 2014, ISBN 780273793298
5. Bjarne Stroustrup, Programming Principles and Practice using C++, Second Edition, Addison Wesley, Pearson Education, 2014, ISBN: 978-0321543721

14CS2040 PROGRAMMING IN JAVA (V-1.1)

Credits 3:0:0

Objective:

- To learn the Java programming language fundamentals: its syntax, idioms, patterns, and styles.
- To learn object oriented programming concepts.
- To learn the essentials of the Java class library.

Outcome:

The student will be able to

- understand the key concepts of object orientation and core java classes & libraries.
- develop desktop applications using GUI.
- develop distributed applications using networking concepts.
- develop simple animation programs using the concept of multithreading and applet.

Introduction to Java, Data Types, Arrays, control statements – Debugging Java Program, Classes, Inheritance, Packages, Interfaces and Exception Handling – Desktop Application development using Classes and Inheritance with Exception Handling - Multithreading, Enumeration, Autoboxing, Annotation and Generics – Application Development using Multithreading with Generics - String Handling, Input/Output, Networking and Applet – Distributed Application using Applet Event Handling and AWT– Layout Managers – Application development using GUI.

Reference Books:

1. Herbert Schildt, Java - The Complete Reference, McGrawHill, Ninth Edition, Oracle Press, 2014, ISBN 13: 978-0-07-180856-9
2. Harvey M. Dietel, Java How to Program, Ninth Edition, Prentice Hall, 2012. ISBN 978-0-13-257566-9
3. Kathy Sierra, Bert Bates, Head First Java, Second Edition, O'Reilly Media, 2005, ISBN: 10-0596004656, ISBN-13:9780596004651.
4. Bruce Eckel, Thinking in Java, Fourth Edition, Prentice Hall, 2006, ISBN: 978-0131872486.
5. Ken Arnold, James Gosling, David Holmes, The Java Programming Language, Fourth Edition, Prentice Hall Professional Technical Reference, 2005, ISBN-13:9780321349804
6. E. Balagurusamy, Programming with Java: A primer, Third Edition, Tata McGraw-Hill, 2007

14CS2050 UNIX ARCHITECTURE (V-1.1)

Pre-requisite: 14CS2037 Operating System

Credits 3:0:0

Objective:

- To learn the internal working of Unix Kernel, its data structures and system calls.
- To describe the algorithms, memory architecture, process management, system calls, interrupts and exceptions, and system start-up.

Outcome:

The student will be able to

- customize the internal algorithms of kernel
- restructure the start-up process of Operating System
- add any new features into the existing operating system

Introduction to the architecture of the UNIX operating system – The buffer cache - advantages and disadvantages - Essential Unix commands – File system layout – INODE - Structure of a regular file, directories- System calls for the file subsystem – pipes—Development of any unix command associated with file operation - process states and transitions – Layout of system memory-– Case study of System memory overflow – The context of a process - Manipulation of the process address space - Process Control: Process Creation - signals – Process termination - process scheduling – System calls for time- clock, Swapping – Demand Paging – The I/O subsystem: driver interfaces – Disk drivers – Integration of "hello world" driver module into Linux kernel Terminal driver's stream, Process Tracing- Development of a debugger application to trace user program – System V IPC – Network Communications - Sockets - Case study - MultiPathTCP in Linux kernel.

Reference Books:

1. Maruice J. Bach, The design of the UNIX operating system, First Edition Reprint, Prentice Hall of India, 2012. ISBN-13 : 978-81-203-0516-8, ISBN-10 : 8120305167
2. Prabhat K. Andleigh, UNIX System Architecture, First Edition Reprint, Prentice Hall, 2005, ISBN: 9780139498435.
3. Kay A. Robbins, Steve Robbins, UNIX Systems Programming, First Edition Reprint, Pearson Education, 2005, ISBN-13: 9788131722084
4. Yashwant Kanetkar**,** Unix Shell Programming, First Edition Reprint, BPB Publications, 2005, ISBN-13 : 978-8170297536
5. Kenneth Rosen, Douglas Host, James Farber, Richard Rosinki, UNIX-The Complete Reference, Second Edition, McGraw- Hill, 2006. ISBN: 9780071706988.
6. Ed Dunphy, The UNIX Industry: Evolution, Concepts, Architecture, Applications and Standards, QED Technical Pub, 2007. ISBN: 089435390X, 9780894353901
7. Charles P. Pfleeger, Shari Lawrence Pfleeger, Security in Computing, Fourth Edition, Pearson Education, 2007. ISBN: 81-317-0113-1

14CS2052 WEB TECHNOLOGY (V-1.1)

Credit 3:0:0

Objective:

- To provide knowledge in the design and development of responsive web applications integrated with database.
- To utilize various open source web application frameworks and its associated plugins to enable rapid web application development.
- To provide knowledge in website publishing, blogging and management using content management system.

Outcome:

The student will be able to

- build interactive data driven websites with Client and server side technologies.
- utilize web application frameworks which facilitate rapid application development.
- integrate web applications easily into other server-side web procedures, such as email, blogs.

HTML5 and its essentials - Interactive elements and Multimedia - Implementing the Advanced Features of HTML5 - CSS3 – Positioning- Layouts - Pseudo-classes and Pseudo-elements - JavaScript - Document Object Model – PHP - PHP Functions and Objects – PHP with MySQL – XML - Implementing Advance features of XML – XSLT - JSON - AJAX - AJAX Frameworks - Integrating PHP and AJAX – jQuery - Servlet and JSP – Struts2 - Building Web Applications using Struts2.

Reference Books:

1. Kogent Learning solutions Inc, HTML 5 Black Book: Covers CSS3, JavaScript, XML, XHTML, AJAX, PHP and jQuery ,Wiley India Pvt Ltd, 2011, ISBN-13: 9789350040959.
2. Robin Nixon, Learning PHP, MySQL and JavaScript, O'Reilly Media, Inc., Third Edition 2014. ISBN: 978-1-4919-4946-7, ISBN 10:1-4919-4946-5.
3. Vishal Layka, Learn Java for Web Development, Apress, (2014, Paperback, New Edition), ISBN-10: 1430259833, ISBN-13: 9781430259831.

14CS2054 C# AND .NET PROGRAMMING (V-1.1)

Pre-requisite: 14CS2035 Object Oriented Programming in C++

Credits 3:1:0

Objective:

- To introduce core and advanced programming constructs in C# and .NET platform.
- To develop windows and web applications along with data access methods.

Outcome:

The student will be able to

- work in various areas in .NET and to understand the concepts in C#
- grow in web development applications using ASP.NET web forms and ADO.NET

.NET Architecture – C# Basics - Objects and Types – Inheritance – Arrays-Operators and Casts - Delegates and Events - Strings and Regular Expressions - Collections-Memory Management and Pointers - Reflection - Errors and Exceptions - Assemblies - Threading and Synchronization- Data Access - Windows Forms - Data Binding - ASP.NET Pages – ASP.NET Development - ASP.NET AJAX.

Reference Books:

1. Christian Nagel, Bill Evjen, Jay Glynn, Morgan Skinner, Karli Watson, Professional C# 2008, Wiley Publishing, Inc., 2008. ISBN: 978-8-126-51627-8.
2. Andrew Troelson, Pro C# 2010 and the .NET 4 Platform, Apress, 2010. Fifth Edition, ISBN: 978-1-4302-2549-2.
3. Kogent Solutions, C# 2012 Programming: Covers .NET 4.5 Black Book, Dreamtech Press, Platinum Edition, 2013. ISBN: 978-9351192107
4. Don Gosselin, ASP .NET Programming with C# and SQL Server, Cengage Learning, 2009, ISBN1423903242

14CS2057 PROGRAMMING IN J2EE (V-1.1)

Pre-requisite: 14CS2040 Programming in Java

Credits 3:1:0

Objective:

- To develop the enterprise applications with cross platform capabilities.
- To explore the concepts of multi-tier distributed applications.
- To understand the working principles of real time enterprise applications.
- To know about various components of J2EE to develop enterprise applications.

Outcome:

The student will be able to

- get a practical exposure to real time web based projects.
- make innovative ideas to develop enterprise applications.

J2EE AND J2SE - J2EE Multi-Tier Architecture - J2EE best practices - Java servlets - Java Server pages – Web Application Development using Servlet and JSP - Enterprise Java Bean – Session Bean – Java Persistence API – Entity Beans – Enterprise Application Development using JPA – Java Message Service - Message Driven Bean - Java remote method invocation – Java Mail API – Security - Java Naming and Directory Interface API – Distributed Application Development with Mailing Facility using SDLC - SOAP - Universal Description, Discovery and Integration (UDDI) - Electronic Business XML - The Java API for XML Registries (JAXR) – Web Services Description Language (WSDL) – Demonstration of Accessing Web Services using Web Service Bindings.

Reference Books:

1. James Keogh, J2EE - The Complete Reference, McGraw-Hill, Twenty Eighth Reprint 2010. ISBN-10:070529124, ISBN-13:9780070529120.
2. Rima Patel, Gerald Brose, Micah Silverman, Mastering Enterprise JavaBeans 3.0, Wiley-India Edition, 2008. ISBN-10: 0471785415, ISBN-13: 978-0471785415
3. Bryan Basham, Kathy Sierra, Bert Bates, Head First Servlets and JSP, O'Reilly Media, 2008, ISBN: 0596516681, ISBN-13: 9780596516680
4. Phil Hanna, JSP 2.0: The Complete Reference, Osborne/McGraw-Hill, Second Edition, December 2002, ISBN-10: 0072224371, ISBN-13: 978-0072224375
5. Esmond Pitt, Kathleen McNiff, Java.rmi: The Remote Method Invocation Guide, Addison-Wesley Professional, 2001. ISBN-10: 0201700433, ISBN-13: 978-0201700435
6. Kathy Sierra, Bert Bates, Head First EJB, O'Reilly Media, 2005. ISBN-10: 0596005717, ISBN-13:978-0596005719

14CS3005 ADVANCED DATABASE SYSTEMS (V-1.1)

Pre-requisite: 14CS2011 Database Systems

Credits 3:0:0

Objective:

- To provide extensive knowledge on the advanced topics in database technologies.
- To provide an application-oriented and system-oriented approach towards database design.

Outcome:

The student will be able to

- understand normalization and indexes and will be able to tune databases efficiently
- understand the concepts of transaction management, concurrency control and other related concepts
- be able to apply locks and isolation levels to the concurrent transactions
- get a exposure on latest trends of database technologies

Overview of query evaluation and transaction management - system catalog - query optimization- transaction management - lock-based concurrency control - performance of locking-concurrency control and recovery – 2PL, serializability and recoverability - lock management - specialized locking techniques - introduction to ARIES - recovery from system crash-database tuning and security and authorization - overview of database tuning - tuning conceptual schema - tuning queries and views - access control - discretionary and mandatory access control-introduction to parallel and distributed databases - architecture - query evaluation - data replication and updation – transaction management - concurrency control – recovery-emerging technologies – XML querying– efficient evaluation of XML queries - spatial data management - spatial indexes - mobile databases - multimedia databases - genome data management.

Reference Books:

1. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill Education, Third Edition, 2014, ISBN: 9789339213114
2. Ramez Elmasri, Fundamentals of Database Systems, Pearson Education India, 2011, ISBN : 8131758982
3. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System concepts, Sixth Edition, Mc Graw-Hill International, 2011, ISBN 9780071325226.
4. Thomas C. and Carolyn B, Database Systems – A Practical Approach to Design, implementation, and Management, Fourth Edition, Pearson Education, 2008, ISBN 978 – 81-317-2025-7
5. Li Yan, Zongmin Ma, Advanced Database Query Systems: Techniques, Applications and Technologies, Idea Group Inc (IGI), 2011,ISBN-160960475X

14CS3006 ADVANCED OPERATING SYSTEMS (V-1.1)

Credits: 3:0:0

Objective:

- To provide comprehensive and up-to-date coverage of the major developments in distributed Operating System, Multi-processor Operating System and Database Operating System
- To cover important distributed operating system concepts like Process Synchronization, Concurrency,
- Event ordering, Mutual Exclusion, Deadlock, Agreement Protocol, Security, Recovery and fault tolerance.

Outcome:

The student will be able to

- understand the architecture of distributed operating system
- understand the issues in designing a distributed operating system

Process synchronization - architectures of distributed systems, theoretical foundations - distributed mutual exclusion - distributed deadlock detection, agreement protocols-distributed file systems - distributed shared memory - distributed scheduling-failure recovery, fault tolerance-resource security and protection - multiprocessor system architectures-introduction to database operating systems - concurrency control- theoretical aspects - concurrency control algorithms.

Reference Books:

1. Mukesh Singhal, Niranjan G.Shivaratri, Advanced Concepts in Operating Systems: Distributed, Database, and Multiprocessor Operating Systems, Tata McGraw-Hill, 200, ISBN: 0-07-047268-8.
2. Ajay D. Kshemkalyani, Mukesh Singhal, Distributed Computing: Principles, Algorithms, and Systems, 2011, Cambridge University Press; Reissue Edition. ISBN-10: 0521189845
3. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, fifth Edition 2011, ISBN-10: 0132143011.
4. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, JohnWiley and Sons, Seventh Edition, 2006. ISBN: 9812-53-176-9.
5. Mary Gorman, Todd Stubbs, Introduction to Operating Systems: Advanced Course, CourseTechnology, 2003. ISBN: 9780619055301.
6. Yair Wiseman, Song Jiang, Advanced Operating Systems and Kernel Applications: Techniques and Technologies, IGI Global Snippet, 2010, ISBN-1605668516

14CS3011 CLOUD COMPUTING SERVICES (V-1.1)

Credits 3:0:0

Objective:

- To introduce the basic concepts of Cloud Computing.
- To introduce new technologies in Cloud Computing.

Outcome:

The student will be able to

- understand Cloud computing and able to setup their own Cloud environment.

Introduction to CLOUD – Cloud Computing Models- Open source cloud computing – Open Stack Cloud – Crowbar- Open stack Core Components – Nova ,Swift,Glance,Dashboard and Keystone – Open Stack Cloud Structure –Admin Node- Control Node-Compute node- Network configuration - Install and configure cloud environment : Preparing the admin host - Install Admin Server using Crowbar - Adding nodes- Cloud administration– Managing users and Projects - Adding Virtual images to cloud – Starting and stopping Virtual machine instances in cloud

Reference Books:

1. Rajkumar Buyya S.Thamarai Selvi, Mastering Cloud Computing: Foundations and Applications Programming, Morgan Kaufmann Publishers In, 2013, ISBN-10: 0124114547
2. Everett Toews, Jonathan Proulx , Lorin Hochstein , Tom Fifield OpenStack Operations Guide: Set Up and Manage Your OpenStack Cloud, O'Reilly Reprints, 2014 First edition, ISBN-13: 978-9351106395
3. Tanja Roth,Frank Sundermeyer, SUSE Cloud Deployment Guide, 2014, Novell Inc., USA
4. Tanja Roth, Frank Sundermeyer, SUSE Cloud Admin User Guide, 2014, Novell Inc., USA
5. Tanja Roth, Frank Sundermeyer, SUSE Cloud End User Guide, 2014, Novell Inc., USA
6. SUS07, Install and Configure SUSE Cloud, Version1.0.1, Lecture Manual, 2013, Novell Inc., USA
7. George Reese, Cloud Application Architectures, O'REILLY, 2009, ISBN 9780596555481.
8. Ivanka Menken, Gerard Blokdjk, Cloud Computing Virtualization Specialist Certification Kit, Emereo Publishing, Second Edition, 2010 ISBN-13: 978-1742444536.

14CS3013 MPLS AND VPN (V-1.1)

Pre-requisite: 14CS2007 Computer Networks

Credits 3:0:0

Objective:

- To expose the students to understand, design, and deploy Multiprotocol Label Switching (MPLS)-based
- Virtual Private Networks (VPNs).
- To learn MPLS theory and configuration, network design issues, and MPLS-based VPNs.
- To get in-depth analysis of MPLS architecture

Outcome:

The students will be able to

- understand how MPLS scales to support tens of thousands of VPNs
- design and deployment of real-world MPLS/VPN networks
- configure MPLS on Cisco devices
- build various VPN topologies

MPLS Architecture Overview, Frame-mode MPLS Operation, Cell-mode MPLS Operation, Running Frame-mode MPLS Across Switched WAN Media, Advanced MPLS Topics, MPLS Migration and Configuration Example, MPLS Troubleshooting, VPN Implementation Options, MPLS/VPN Architecture Overview, MPLS/VPN Architecture Operation, Provider Edge (PE) to Customer Edge (CE) Connectivity

Reference Books:

1. Uyless Black, MPLS and Label Switching Networks, Prentice Hall, 2002, 2nd edition, ISBN: 978-0130158239
2. Sean Harnedy, The MPLS Primer: An Introduction to Multiprotocol Label Switching, 2001, Prentice Hall, ISBN: 978-0130329806
3. Ivan Pepelnjak, Jim Guichard, MPLS and VPN Architectures CCIP Edition, 2013, Pearson Education Limited, Cisco Press, ISBN: 13: 978-1587143236
4. Ruixi Yuan, W. Timothy Strayer, Virtual Private Networks: Technologies and Solutions, 2001, Addison-Wesley Professional, ISBN: 978-0201702095
5. Dave Kosiur, Building and Managing Virtual Private Networks, Wiley, ISBN: 978-0471295266
6. Dennis Fowler, Virtual Private Networks: Making the Right Connection, Morgan Kaufmann, 1999,ISBN: 978-1558605756
7. Luc De Ghein, MPLS Fundamentals, 2006, Cisco Press, ISBN: 1-58705-197-4

14CS3037 REQUIREMENTS ENGINEERING (V-1.1)

Pre-requisite: 14CS2042 Software Engineering

Credits 3:0:0

Objective:

- To give a general introduction to the requirement engineering process.
- To know different approaches to model requirement engineering process.
- To understand the importance of human, social and organization factors influence those processes.

Outcome:

The student will be able to

- improve the capability of gathering requirement for projects.
- identify factors involved for requirement engineering.
- classify the types of requirements needed for project.
- understand how requirements engineering leads towards a good design.

The essential software requirement - requirements from the customer's perspective - good practices for requirements engineering –requirements development process –requirements analyst-establishing the product vision and project scope – finding the voice of the customer-understanding user requirements-documenting the requirements - the data dictionary –modeling the requirements diagrams – decision tables and decision trees-requirements management principles and practices - the change control process –links in the requirements chain - tracing requirements - improving requirements processes - software requirements and risk management

Reference Books:

1. Karl E. Wiegers, Joy Beatty, Software Requirements, Wiley India Private Limited, Third Edition, 2013, ISBN-10: 9351192032, ISBN-13: 978-9351192039
2. Elizabeth Hull, Ken Jackson, Jeremy Dick, Requirements Engineering, Third Edition, Springer Publication, 2011. ISBN: 9781849964050.
3. Murali Chemuturi Requirements Engineering and Management for Software Development Projects, Springer, 2013, ISBN : 978-1-2614-5377-2
4. Ralph R. Young, Effective Requirements Practices, Addison Wesley, 2001. ISBN: 0-201-70912-0.
5. Richard H. Thayer, Merlin Dorfman, Sidney C. Bailin, Software Requirements Engineering, Second Edition, Wiley, 1997 Digitized 2009, ISBN: 0818677384

14CS3041 SOFTWARE METRICS AND QUALITY MANAGEMENT (V-1.1)

Pre-requisite: 14CS2042 Software Engineering
Credits: 3:0:0

Objective:

- To understand how to choose appropriate quality goals and to select, to plan, and to execute quality assurance activities throughout development and evolution to predictably meet quality and schedule goals.
- To study the software quality engineering metrics and models

Outcome:

The student will be able to

- employ software metrics and models in software development
- select the best quality assurance plan during development

Overview of software metrics : the basics of measurement – goal based paradigms – empirical investigation – measuring internal product attributes : software size ,structure – measuring external product attributes – measuring software reliability – models of cost and effort – software test metrics – elements of software quality system – standards – reviews – testing - defect analysis – configuration management - associated quality concerns – software documentation – quality system implementation.

Reference Books:

1. John W. Horch, Practical Guide to Software Quality Management, Second Edition, Artech House Computer Library, 2003.
2. Stephen H. Kan, Metrics and Models in Software Quality Engineering, Second Edition, Pearson, ISBN: 813170324x, 2003.
3. John C. Munson, Software Engineering Measurement, Auerbach Publications, 2003. ISBN: 0849315034.
4. Norman.E. Fenton, James Bieman, Software Metrics: A Rigorous and Practical Approach, Third Edition, Taylor and Francis, 2014, ISBN 1439838224, 9781439838228.
5. Gerald M. Weinberg, Quality Software Management: Anticipating Change, Dorset House Publishing Company, 1997.
6. B A Kitchenham, Software Metrics: Measurement for Software Process Improvement, Blackwell Pub, 1996. ISBN: 1855548208.

14CS3042 SOFTWARE PROJECT MANAGEMENT (V-1.1)

Pre-requisite: 14CS2042 Software Engineering

Credits 3:0:0

Objectives:

- To understand Traditional Project Management, Resource Requirements and Cost.
- To create project Management Life Cycles and Strategies.
- To build an effective Project Management Infrastructure.

Outcome:

The student will be able to

- understand the developing high quality software systems, principles, concepts and techniques associated with software development.
- analyze and evaluate problems and draw on the theoretical and technical knowledge to develop and implement plans for their resolution.

Introduction to Software Project Management –Understanding the Project Management Process Groups - How to Scope a Project – Defining and sing Project Management Process Groups - How to Plan a Project-How to launch a Project-How to Monitor and Control a Project-How to close a Project – Establishing Project Management Life Cycles and Strategies - Project Management Landscape - Traditional Project Management - Using Critical Chain Project Management-Agile Project Management - Building an effective Project Management Infrastructure - Establishing and Maturing a Project Support Office- Project Portfolio Management - Project Management Concepts Process and Project Metrics - Estimation for Software Projects - Project Scheduling -Risk Management - Maintenance and Reengineering.

Reference Books:

1. Robert K. Wyzocki, Rudd McGary, Effective Project Management, Fifth Edition, WILEY-Dreamtech India Pvt. Ltd., 2009, ISBN: 978-81-265-2156-2
2. Ashfaque Ahamed, Software Project Management - A Process Driven Approach, CRC Press, Taylor and Francis Group, An Auerbach Book, ISBN: 9781439846551
3. Roger S Pressman, Software Engineering: A Practitioner's Approach, Seventh Edition, McGraw-Hill Higher Education, 2009. ISBN: 0073375977, 9780073375977.
4. Pankaj Jalote, Software Project Management in practice, Addison-Wesley, 2002. ISBN: 0201737213, 9780201737219
5. Walker Royce, Software Project Management – A Unified Framework, Pearson Education, 2004. ISBN: 0201309580, 9780201309584
6. Bob huges, Mike cotterell, Software Project Management, Tata McGraw Hill, New Delhi, 2006, Fourth Edition, ISBN: 13 978-0-07-710989-9, 10 0077109899

14CS3054 DATABASE SECURITY (V-1.1)

Pre-requisite: 14CS2011 Database Systems

Credit: 3:0:0

Objectives:

- To learn the security issues pertaining with database servers.
- To survey the security problems existing in popular database systems.
- To know about various database securing technique

Outcome:

Students will be able to

- secure database systems in their network
- audit a customer's network for database security problems.

Need for Database Security, Oracle architecture, Attacking Oracle, Oracle: Moving Further into the Network, Securing Oracle-IBM DB2 Universal Database, DB2 Discovery, attack, Defense, Securing DB2.Informix:Information Architecture, Informix: Discovery, attack, defense, Securing Informix-Sybase Architecture, Sybase: Discovery, Attack, and Defense, Moving further into the network, Securing Sybase-MySQL Architecture , Discovery, attack and Defense, MySQL: Moving further into network, Securing MySQL-SQL server Architecture, Exploitation, Attack, Defense, Securing SQL Server.

Reference Books:

1. David Litchfield, John Heasman, Defending, Database Servers-The Database Hacker's Handbook, WileyDreamtech India (P) Ltd, 2005, ISBN: 81-265-0615-6.
2. Ron Ben Natan, Implementing Database Security and Auditing, Elsevier, 2005. ISBN: 81-312- 0134-1.
3. Ramez Elmasri, Navathe, Fundamentals of Database System, Sixth Edition, 2011. ISBN: 10-0-136-08620-9, ISBN: 978-0-135-08620-8
4. David Litchfield, The Oracle Hacker's Handbook: Hacking and Defending Oracle, Wiley, First Edition Year 2007 ISBN-13: 978-0470080221

14CS3059 WEB SERVICES (V-1.1)

Credits 3: 0: 0

Objectives:

- To understand web service technology and usage.
- To get a general idea about the models and architectures of web services
- To discuss about a standardized framework for applications to communicate over the internet.

Outcome:

The student will be able to

- Design and launch Web services.
- Employ web service architectures and will able to use the corresponding standards like WSDL, SOAP, UDDI and RPC for developing web applications.
- Develop registration and discovery techniques for Web services.
- Evaluate emerging and proposed standards for the main components of web service architectures.

Evolution of Distributed Computing-Introduction to Web Services-Building the Web Services Architecture-Developing Web Services using SOAP-Description and Discovery of Web Services-Creating .Net Interoperability-Introduction to Java Web Services Developers Pack (JWSDP)-XML Processing and Data Binding with Java APIs-XML Messaging using JAXM and SAAJ-Building RPC Web Services with JAX-RPC–Java API for XML Registers-Using the Java Web Services Developer Pack: Case Study-Web Services Security-Introduction to SUN ONE.

Reference Books:

1. Ramesh Nagappan, Robert Skoczylas, Rima Patel Sriganesh, Developing Java Web Services, Wiley Publishing Inc, 2008, ISBN 10:81-265-0499-4, ISBN 13:978-81-265-0499-2.
2. Sandeep Chatterjee, James Webber, Developing Enterprise Web Services, Pearson Education, 2007, ISBN:81-317-1317-2
3. Steve Graham et al., Building Web Services with Java, Pearson Education, 2008, ISBN: 81-317-1813-1.
4. Martin Kalin, Java Web Services, O'reilly Publications, 2009, ISBN: 978-0-5916-52112-7.
5. Robert Daigneau, Service Design Patterns: Fundamental Design Solutions for SOAP/WSDL and RESTful Web Services, Pearson Education, 2011, ISBN: 978-0-321-54420-9
6. G Alonso, Web Services: Concepts, Architectures and Applications, Orient Black Swan Publications, 2009,ISBN 10: 8184891709, ISBN 13: 9788184891706.
7. Eric Armstrong, et al, The Java Web Services Tutorial, Pearson Education, 2005, ISBN-10: 0201768119, ISBN-13: 978-0201768114 .
8. Ron Schmelzer, XML and Web Services, Sams, First Edition, 2002, ISBN-10: 0672323419, ISBN-13: 978-0672323416

14CS3064 NETWORK SECURITY (V-1.1)

Credits 3:0:0

Objective:

- Explain the basic concepts in network security.
- Introduce the fundamental techniques in implementing secure network communications.

Outcome:

The students will be able to:

- understand the concepts related to applied cryptography, including authentication, Intrusion detection, digital signatures, etc.
- identify the probable threats and mechanisms to protect against the threats.
- identify the requirements of security for real time applications such as for email and other web based applications

Message authentication – overview of authentication systems - Kerberos – electronic mail security – IP security – web security – network management security – intrusion detection – firewall design principles – Network Access Control – Malicious Software

Reference Book:

1. William Stallings, Network Security Essentials Applications and Standards, Fifth Edition, Prentice Hall, 2013, ISBN-13: 978-0133370430
2. William Stallings, Cryptography and Network Security, Fifth Edition, Prentice Hall, 2011, ISBN-13: 978-0136097044
3. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security: Private Communication in a Public World, Second Edition, Reprint 2008, Prentice Hall, ISBN-13: 978-0130460196
4. Jan L. Harrington, Network Security: A Practical Approach, Morgan Kaufmann Publishers, Reprint 2006, ISBN-13: 978-0123116338

14CS3071 PERVASIVE COMPUTING (V-1.1)

Credits 3:0:0

Objective:

- To gain an insight into future developments in the field of pervasive computing.
- To provide an in depth knowledge on pervasive computing and wireless networking.
- To describe the variety of pervasive services and applications.

Outcome: Students will be able to

- Learn pervasive services and applications.

What Pervasive Computing Is All About-Devices: Information Access Devices - Embedded Controls - Entertainment Systems - Operating Systems-Middleware Components-Mobile Internet –Connectivity-Service Discovery- Gateways-Application Servers-Internet Portals-Device Management-Synchronization-Home services-Travel Services-Business Services-Consumer Services.

Reference Books:

1. Uwe Hansmann, Lothar Merk, Martin S. Nicklous, Thomas Stober, Pervasive Computing, Springer, 2003, ISBN:3-540-67122-6
2. Burkhardt J, Henn H, Hepper S, Rintdorff K., Schack T, Pervasive Computing: Technology and Architecture of Mobile Internet applications, Addison Wesley, 2012
3. Asoke K Talukder, Roopa R Yavagal, Mobile computing: Technology, Applications and Service Creation,Tatas McGraw-Hill Publishing Company Limited, 2005, ISBN 0 – 07 - 058807 – 4
4. Frank Adelstein, S K S Gupta, G G Richard, L Schwiebert, Fundamentals of Mobile and Pervasive Computing, Tata McGraw-Hill, New Delhi, 2005

LIST OF SUBJECTS

Subject Code	Name of the Subject	Credits
14CS1001	Fundamentals of Computing and Programming	3:0:0
14CS1002	Fundamentals of Computing and Programming Lab	0:0:2
14CS2001	Analysis of Algorithms	3:0:0
14CS2002	Business Intelligence	3:0:0
14CS2003	CASE Tools Lab	0:0:2
14CS2004	Database Administration	3:0:0
14CS2005	Computer Architecture	3:0:0
14CS2006	Computer Graphics	3:0:0
14CS2007	Computer Networks	3:0:0
14CS2008	Cryptography and Network Security	3:0:0
14CS2009	Data Structures	3:0:0
14CS2010	Data Structures Lab	0:0:2
14CS2011	Database Systems	3:0:0
14CS2012	Database Systems Lab	0:0:2
14CS2013	Machine Learning Principles and Applications	3:0:0
14CS2014	Ad Hoc Networks	3:0:0
14CS2015	E-Commerce	3:0:0
14CS2016	Enterprise Resource Planning Lab	0:0:2
14CS2017	Enterprise Resource Planning	3:0:0
14CS2018	Ethics in Information Technology	3:0:0
14CS2019	Management Information Systems	3:0:0
14CS2020	Fundamentals of Human Computer Interaction	3:0:0
14CS2021	Information Security	3:0:0
14CS2022	Information Security Lab	0:0:2
14CS2023	Information Systems Strategy Planning and Management	3:0:0
14CS2024	Intelligent Systems	3:0:0
14CS2025	IT Infrastructure and Management	3:0:0
14CS2026	Java Programming Lab	0:0:2
14CS2027	Internet Routing Architecture	3:0:0
14CS2028	Software Engineering Lab	0:0:2
14CS2029	Mobile Application Development Lab	0:0:2
14CS2030	Multimedia Systems and Design	3:0:0
14CS2031	Service Oriented Architecture	3:0:0
14CS2032	Network Security Lab	0:0:2
14CS2033	Networking Lab	0:0:2
14CS2034	Object Oriented Analysis and Design	3:0:0
14CS2035	Object Oriented Programming in C++	3:0:0
14CS2036	Object Oriented Programming in C++ Lab	0:0:2
14CS2037	Operating System	3:1:0
14CS2038	Principles of Compiler Design	3:0:0

14CS2039	Computer Graphics and Applications Lab	0:0:2
14CS2040	Programming in Java	3:0:0
14CS2041	IP TV and Internet Video	3:0:0
14CS2042	Software Engineering	3:0:0
14CS2043	Virtualization	3:0:0
14CS2044	Introduction to System Administration	3:0:0
14CS2045	System Software	3:0:0
14CS2046	System Software and Compiler Lab	0:0:2
14CS2047	Theory of Computation	3:1:0
14CS2048	Total Quality Management	3:0:0
14CS2049	Unix and Linux Lab	0:0:2
14CS2050	Unix Architecture	3:0:0
14CS2051	Internet Routing Protocols lab	0:0:2
14CS2052	Web Technology	3:0:0
14CS2053	Web Technology Lab	0:0:2
14CS2054	C# and .NET Programming	3:1:0
14CS2055	C# and .NET Programming Lab	0:0:2
14CS2056	Design Patterns	3:0:0
14CS2057	Programming in J2EE	3:1:0
14CS2058	Programming in J2EE Lab	0:0:2
14CS2059	Programming in J2ME Lab	0:0:2
14CS2060	Visual Programming	3:0:0
14CS2061	Visual Programming Lab	0:0:2
14CS2062	Programming in J2ME	3:0:0
14CS2063	Mobile Application Development using Android	3:1:0
14CS2064	Mobile Computing	3:0:0
14CS2065	Storage Area Network	3:0:0
14CS2066	TCP/IP	3:0:0
14CS2067	Wireless and VOIP Security	3:0:0
14CS2068	Essentials of Programming	3:0:0
14CS2069	Essentials of Programming Lab	0:0:2
14CS2070	Multimedia Lab	0:0:2
14CS3001	Access and Identity Management	3:0:0
14CS3002	Multimedia Design Storage and Analysis	3:0:0
14CS3003	Advanced Computer Architecture	3:0:0
14CS3004	Advanced Database Lab	0:0:2
14CS3005	Advanced Database Systems	3:0:0
14CS3006	Advanced Operating Systems	3:0:0
14CS3007	Advanced Operating Systems Lab	0:0:2
14CS3008	Analysis, Architecture and Design of Networks	3:0:0
14CS3009	Applied Security Lab	0:0:2
14CS3010	Cloud Computing Lab	0:0:2
14CS3011	Cloud Computing Services	3:0:0

14CS3012	User Interface Design	3:0:0
14CS3013	MPLS and VPN	3:0:0
14CS3014	Computer Graphics and Applications	3:0:0
14CS3015	Data Mining Lab	0:0:2
14CS3016	Applied Medical Image Processing	3:0:0
14CS3017	Design and Analysis of Algorithms	3:0:0
14CS3018	Mobile Ad Hoc Networks	3:0:0
14CS3019	Distributed Systems	3:0:0
14CS3020	Grid Computing	3:0:0
14CS3021	High Performance Networks	3:0:0
14CS3022	Computing Security Lab	0:0:2
14CS3023	Information Storage Management	3:0:0
14CS3024	Internetworking	3:0:0
14CS3025	Internetworking and Security Lab	0:0:2
14CS3026	Pattern Recognition	3:0:0
14CS3027	Software Architecture Restructuring	3:0:0
14CS3028	Network Design and Management Lab	0:0:2
14CS3029	Network Management	3:0:0
14CS3030	3D Modeling and Rendering	3:0:0
14CS3031	Object Oriented CASE Tools Lab	0:0:2
14CS3032	Object Oriented Software Engineering	3:0:0
14CS3033	Operating Systems and Networking Lab	0:0:2
14CS3034	Information Security	3:0:0
14CS3035	Real Time System Software	3:0:0
14CS3036	Real Time Systems	3:0:0
14CS3037	Requirements Engineering	3:0:0
14CS3038	Security in Computing	3:0:0
14CS3039	Software Architecture	3:0:0
14CS3040	Enterprise Service Oriented Architecture	3:0:0
14CS3041	Software Metrics and Quality Management	3:0:0
14CS3042	Software Project Management	3:0:0
14CS3043	Software Testing	3:0:0
14CS3044	Software Testing Lab	0:0:2
14CS3045	Software Agents	3:0:0
14CS3046	System Administration	3:0:0
14CS3047	System Administration Lab	0:0:2
14CS3048	System Development Lab	0:0:2
14CS3049	Information Security Audi and Assurance	3:0:0
14CS3050	Wireless Networks Lab	0:0:2
14CS3051	Wireless Sensor Networks	3:0:0
14CS3052	Cloud Computing	3:0:0
14CS3053	Data warehouse	3:0:0
14CS3054	Database Security	3:0:0

14CS3055	Interactive Game Design	3:0:0
14CS3056	Internetworking Multimedia	3:0:0
14CS3057	Multimedia Database	3:0:0
14CS3058	Virtual Reality Technology	3:0:0
14CS3059	Web Services	3:0:0
14CS3060	Semantic Web	3:0:0
14CS3061	Knowledge Management	3:0:0
14CS3062	Routing and Switching Techniques	3:0:0
14CS3063	Artificial Intelligence for Games	3:0:0
14CS3064	Network Security	3:0:0
14CS3065	Big Data Analytics	3:0:0
14CS3066	IP Telephony	3:0:0
14CS3067	Soft Computing	3:0:0
14CS3068	Evolutionary Computing	3:0:0
14CS3069	Computer Vision	3:0:0
14CS3070	Quantum Computing	3:0:0
14CS3071	Pervasive Computing	3:0:0
14CS3072	Parallel Computing	3:0:0
14CS3073	Web Security	3:0:0
14CS3074	Advanced Data mining	3:0:0
14CS3075	Wireless Security	3:0:0
14CS3076	Cyber Forensics	3:0:0
14CS3077	Elements of Multimedia Systems	3:0:0
14CS3078	Multimedia Communication	3:0:0
14CS3079	Internetworking Lab	0:0:2
14CS3080	Embedded Linux	3:0:0
14CS3081	Real Time Unified Modeling Language	3:0:0
14CS3082	Real Time Operating Systems	3:0:0

14CS1001 FUNDAMENTALS OF COMPUTING AND PROGRAMMING

Credits: 3:0:0

Objectives:

- To learn basics of computing
- To enhance the problem solving skills
- To empower the students with an idea of developing the programming logic
- To learn about the basics of C programming

Outcome:

Students will be able to

- understand the fundamentals of Computer models
- understand the basics of C programming language
- understand the emphasis of conceptual design and implementation of programming languages.

Fundamentals of Computers, Number System, Computer Software, Hardware, Information Technology and Internet. Introduction to Programming, Problem solving Techniques, Variables and Constants, Data Types, Operators and

Priority, Input and Output in C. Control statements: Branching, Selection, Looping statements, break, continue, goto statement. Functions, Arrays, Functions with Pointers, Pointer to Function, Strings, Storage classes in C. User-defined Data Types, Structure, Array of Structures, Union.

Reference Books:

1. Ashok N. Kamthane. "Computer Programming", Second Edition, Pearson Publications, New Delhi,2012, ISBN: 978-81-317-6494-7.
2. Byron S. Gottfried, "Programming with C", Indian Adapted Edition, Tata McGraw Hill, 2006, ISBN: 0-07-059369-8.
3. Herbert Schildt, "The Complete Reference C", Fourth Edition, McGraw-Hill Publications, 2007, ISBN: 978-0072121247.
4. Yashwant kanetkar, "Let us C",10th Edition, BPB Publications,2010, ISBN: 978-81-8333-163-0.
5. Kashi Nath Dey, Samir Bandyopadhyay, "C Programming Essentials", 2010, Dorling Kindersley (India) Pvt. Ltd., ISBN: 978-81-317-2889-5.
6. Anita Goel, Ajay Mittal, "Computer Fundamentals and Programming in C", 2013, Dorling Kindersley (India) Pvt. Ltd., ISBN: 978-93-325-1934-3.
7. E.Balagurusamy, "Programming in ANSI C", Sixth Edition, Tata McGraw Hill, 2012, ISBN: 978-1-25-900461-2.

14CS1002 FUNDAMENTALS OF COMPUTING AND PROGRAMMING LAB

Co-requisite: 14CS1001 Fundamentals of Computing and Programming

Credits: 0:0:2

Objectives:

- To learn basic C program
- To learn looping control structures in C
- To learn Operators and Functions in C
- To learn about the Arrays and Structures in C

Outcome:

Students will be able to

- Implement the concepts of programming in C
- Implement the structured data types programs in C
- Design and implement a given scenario.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2001 ANALYSIS OF ALGORITHMS

Pre-requisite: 14CS2009 Data Structures

Credits: 3:0:0

Objective:

- To provide an introduction to asymptotic algorithm analysis.
- To develop algorithms for sorting, searching, insertion and matching.
- To introduce the concept of computational intractability and NP completeness.

Outcome:

The student will be able to

- design algorithms for problems.
- calculate the efficiency of different types of algorithms for the same problem.

Introduction to Algorithm – Fundamentals of the analysis of algorithm efficiency, Asymptotic notations and basic efficiency classes – Mathematical analysis of recursive and non-recursive algorithms - Brute force - Divide-and-Conquer, Decrease-and-Conquer - Transform-and-Conquer, Space and Time Tradeoffs - Dynamic Programming, Greedy technique - Iterative improvement - Limitations of algorithm power

Reference Books:

1. Anany Levitin, "Introduction to the Design and Analysis of Algorithms", Pearson Education, 2007. ISBN-10: 0321358287
2. S. K. Basu, "Design Methods and Analysis of Algorithms, Prentice-Hall India", 2005. ISBN: 81-203-2637-7.
3. Jeffrey Mcconnell, "Analysis of Algorithm", Jones and Battlet, 2008. ISBN-10: 07637-0782-1.
4. Cormen, Leiserson, Rivest, Stein, "Introduction to Algorithms", Third Edition, Prentice Hall, 2010,ISBN 9788120340077.
5. A.V. Aho, J. E. Hopcroft and J. D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education Asia, 2003.
6. Sara Baase and Allen Van Gelder, "Computer Algorithms - Introduction to Design and Analysis", Pearson Education Asia, 2003.
7. Jon Bentley, "Programming Pearls", Second Edition, Pearson Education, 2000, ISBN 0201657880.

14CS2002 BUSINESS INTELLIGENCE

Credits: 3:0:0

Objective:

- To provide enhanced knowledge on business intelligence and the techniques for gathering, storing, analyzing, and Reporting.
- To impart knowledge about decision support system, online analytical processing (OLAP), statistical analysis, forecasting, and data mining.

Outcome:

The student will be able to

- apply the business intelligence process across the organization
- make predictive analytics work for your bottom line
- blend business intelligence process into daily management activities

Introduction to business intelligence-what business intelligence can do for you-the data mart -defining business intelligence structures - data mart - package items -analyzing cube content -MDX scripting - additional dimensions – mining - what is data mining? - data mining structure- mining accuracy chart -delivering: reporting services - report manager.

Reference Books:

1. Brain Larson, Delivering Business Intelligence with Microsoft SQL server 2008, McGraw Hill,2008, ISBN: 978-0071549448
2. Lynn Langit, Foundations of SQL Server 2005 Business Intelligence , Apress 2007, ISBN 978-1590598344
3. Paul Turley, Thiago Silva, Bryan C. Smith, Ken Withee , Professional Microsoft SQL Server 2008 Reporting Services , John Wiley and Sons, 2011, ISBN:1118059549, 9781118059548
4. Philo Janus, Guy Fouche , Pro SQL Server 2008 Analysis Services, : Apress, 2010, ISBN:1430219955.

14CS2003 CASE TOOLS LAB

Credits: 0:0:2

Co-requisite: 14CS2034 Object Oriented Analysis and Design

Objective:

- To enable the students to design UML diagrams and to develop applications.
- To help the students to visualize the structure of the system and to reduce the system development time thereby increasing the productivity according to the industrial standards.

Outcome:

The student will be able to

- understand the importance of systems analysis and design in solving complex problems.
- construct various UML models using the appropriate notation.
- apply the rational software suit for the construction of UML models and expressing the appropriate notation associated with each model.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2004 DATABASE ADMINISTRATION

Pre-requisite: 14CS2011Database Systems

Credits: 3:0:0

Objective:

- To provide an overview of database architecture.
- To impart knowledge on database creation and user management.
- To introduce the concepts of database backup and recovery.

Outcome:

The student will be able to

- design, create and maintain the database.
- perform user management and storage management.
- perform database backup and recovery.

Database Architecture - Database Creation – Deletion- Planning and managing Tablespaces - Physical Database Layouts and Storage Management – User Management - Monitoring Space Usage –Managing Transactions with Undo Tablespaces- Backup and Recovery Options.

Reference Books:

1. Bob Bryla,Kevin Loney, "Oracle Database 11g DBA Handbook", The McGraw-Hill Companies,2008,ISBN -0-07-159579-1.
2. Sam R Alapatti, "Expert Oracle Database 11G Administration", Apress Publication, First Edition, 2009, ISBN-13-4302-1015-3.
3. Iggy Fernandez, "Beginning oracle Database 11g Administration from Novice to Professional",2009, ISBN-978-81-8489-216-1.
4. Kognet, "Oracle 11G Administration in simple steps" Dream Tech Press, First Edition, 2008, ISBN 10-81-7722-854-4, ISBN : 13-978-81-7722-854-0.

14CS2005 COMPUTER ARCHITECTURE

Credits: 3:0:0

Objective:

- To provide knowledge on the of the fundamentals of computer architecture.
- To discuss in detail the operation of the control unit and arithmetic operations.
- To study in detail the different types of control and the concept of pipelining.

Outcome:

The student will be able to

- understand the architecture and organization of computer and internal working.
- get a detailed knowledge about arithmetic, addressing modes instruction execution, pipelining and working of micro-operations.

Introduction of computer organization and architecture - A Top Level View of Computer Function and Interconnection – Interrupts - Multiple interrupts - Cache Memory - Internal Memory - Input / Output Modules – Programd I/O – Interrupt driven I/O – Direct Memory Access- Computer Arithmetic – Integer Representation and arithmetic-Floating point Representation and Arithmetic - Instruction Sets – Characteristics and Functions – Addressing Modes - Processor Structure and Function - Control Unit Operation - Micro Programd Control

Reference Books:

1. William Stallings, Computer Organization and Architecture: Designing for Performance, Eighth Edition, Pearson Education, 2010, ISBN:8131732452
2. John P.Hayes, Computer Organization and Architecture, McGraw Hill, Third Edition, 2002, ISBN: 0070273553
3. John L.Hennessy, David A.Patterson, Computer Architecture: A Quantitative Approach, Morgan Kaufmann, Fifth Edition, 2012, ISBN: 978-0-12-383872-8
4. Andrew S. Tanenbaum, Todd Austin, "Structured Computer Organization" Prentice Hall, Sixth Edition, 2013, ISBN-10: 0132916525.
5. Douglas E. Comer, "Essentials of Computer Architecture", Addision-Wesely, First Edition, 2005, ISBN-10: 0131491792

14CS2006 COMPUTER GRAPHICS

Credits: 3:0:0

Objective:

- To understand the fundamental idea of graphics and animation.
- To learn the concept of principles of 2D graphics, 3D graphics, visible surface determination.

Outcome:

The student will be able to

- understand the basic concepts of geometric modeling and computer graphics.
- develop intuitive, attractive and efficient designs that maintain a crisp clarity along aesthetic lines.
- develop skills in the design and analysis of practical engineering problems through the integration of geometric modeling, and computer graphics.

Basic Principles of Two Dimension Graphics- Raster Versus Vector Graphics- Geometric Transformations- Applications Of Transformations- Animation And Movements Based On Transformations - Drawing Lines And Curves- Areas, Text and Colours- Buffered Images In Java 2D- Colour Model - Basic Principles Of Three Dimensional Graphics- Geometric Transformations- Elementary Geometric Objects In Java 3D- Animations And Moving Objects- Modelling Three Dimensional Objects - Visible Surface Determination-Clipping Volumes-Algorithms For Visible Surface Determination- Priority Algorithms-Illumination And Shading- Shadows-Transparency- The Radiosity Model-Ray Tracing - Special Effects And Virtual Reality-Fog and particle systems-Fog in Java 3D- Collision detection-Collision detention in Java 3D-Sound effects.

Reference Books:

1. Frank Klawonn,Introduction to Computer Graphics Using Java 2D and 3D, Springer, 2008, ISBN: 978-1-84628-847-0
2. Rick Parent, Computer Animation Algorithms and Techniques, Morgan Kaufmann publishers, 2012, ISBN 978-0-12-415842-9.
3. James D.Foley, et al, Computer Graphics Principles and Practices, Addison Wesley, 1997, 0201848406.
4. F.S.Hilljr, Computer graphics using Open GL, Prentice Hall of India,2006,ISBN-81-203-2813-2.
5. Peter Shirley, et al, Fundaments of Computer Graphics, AK Peters Ltd, 2005, ISBN: 978-1-56881-269-4.
6. Issac Victor Kerlow, The Art of 3D Computer Animation and Effects, John Wiley, Fourth Edition, 2009, ISBN: 047008490, 9780470084908.

14CS2007 COMPUTER NETWORKS

Credits: 3:0:0

Objective:

- To introduce key trends on network principles and practices.
- To provide a top down approach which focus on the internet and its accessible styles.

Outcome:

The student will be able to

- understand the organization of computer networks, factors influencing computer network development and the reasons for having different types of networks.
- understand the internet structure and can see how standard problems are solved in that context.
- analyze network protocols and understand literature concerning computer networks.

Computer Networks and the Internet - The application layer – Principles of network Applications - The Web and HTTP - File Transfer: FTP - Electronic Mail in the Internet – DNS -P2P File Distribution - Socket Programming using TCP and UDP- The transport layer – Services - Multiplexing and Demultiplexing - Connectionless Transport: UDP -Principles of Reliable Data Transfer - Connection-Oriented Transport: TCP- The network layer - Virtual Circuit and Datagram Networks - What's Inside a Router? - The Internet Protocol (IP): Forwarding and Addressing in the Internet - Routing Algorithms - Routing in the Internet- The link layer - Error-Detection and -Correction Techniques - Multiple Access Links and Protocols- Switched Local Area Networks – Network Management

Reference Books:

1. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach Featuring the Internet, sixth Edition, Addison-Wesley, 2013, ISBN-13: 9780132856201
2. William Stallings, Data and Computer Communications, Prentice Hall, Eighth Edition, 2007,ISBN9780132433105
3. Andrew S.Tanenbaum, Computer Networks, Prentice Hall of India, Fifth edition, 2010 ISBN-13: 978-0132126953.
4. Fred Halsall, Computer Networking and the Internet, Fifth Edition, Addison-Wesley, 2005, ISBN 9780321263582
5. Kevin R. Fall, W. Richard Stevens, TCP/IP Illustrated Volume – I: The Protocols, Addison Wesley Professional Computing Series, 2011, Second Edition, ISBN-13:978-0321336316.

14CS2008 CRYPTOGRAPHY AND NETWORK SECURITY

Credits: 3:0:0

Objective

- To facilitate the students to understand the different kinds of security issues.
- To introduce the various principles of cryptosystems.
- To make the students aware of hashing algorithms and digital signatures.

Outcome:
The student will be able to

- put into practice the various symmetric and asymmetric key algorithms.
- understand the importance of network security.
- handle different kinds of attacks.

Overview of computer security – Security attacks – Services – Mechanisms - Block cipher - DES – AES -Public-key Cryptography and RSA – Key Management– Diffie – Hellman Key Exchange – Elliptic Curve Cryptography - Secure Hash Algorithm – Whirlpool – CMAC –HMAC – Digital Signature Standard – Kerberos – X.509 Authentication Service-E-mail Security – Pretty Good Privacy – S/MIME - IP security -Transport level security – Intruders – Firewalls-Trusted systems.

Reference Books:

1. William Stallings, Cryptography and Network Security, Fourth Edition, Prentice Hall, 2006. ISBN: 81-203-3018-8.
2. Bruce Schneier, Applied Cryptography, Second Edition, John Willey and Sons, 2007. ISBN: 8126513683
3. Wenbo Mao, Modern Cryptography, First Edition, Pearson Education, 2008 ISBN: 978-81-317-0212-3
4. Roberta Bragg, Mark Rhodes, Keith Strassberg, Network Security, Tata Mcgraw Hill Edition,2008. ISBN-13: 978-0-07-058671-0
5. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, Second Edition, Prentice Hall, 2002. ISBN: 81-203-2213-4.

14CS2009 DATA STRUCTURES

Credits: 3:0:0

Objective:

- To understand the concept of various data structures.
- To know about different applications of data structures.
- To enable the students to implement applications on Data Structures using C++ programming language.

Outcome:
The student will be able to

- find and understand the data structures used in different applications
- design and implement various hybrid data structures suitable for different applications

Introduction to Data Structure - Stack definition-specification and implementation- Case Study on Stack Applications - Queue definition-implementation-examples- Queue Types-List types and implementation-Linked implementation of stack and queue – Simulation of Real Time Scenario using Queue - Tables and information retrieval-Arrays-Searching techniques-Sorting Techniques – Development of Optimized Searching / Sorting Technique - Binary tree definition-implementation-Traversals-Binary tree variants and implementation – Case Study on Various Trees and its Applications - Graph mathematical background- implementation-Traversals-Shortest Path Algorithms – Application Development using Graph.

Reference Books:

1. Ellis Horowitz, Sartaj Sahni and Susan Anderson-Freed, "Fundamentals of Data Structures in C", Second Edition, 2007, ISBN: 0-929306-40-6.
2. Jean-paul Tremblay, Paul G. Sorenson, "An Introduction of Data Structures with Applications", McGraw Hill Computer Science Series, Second Edition, 2001, ISBN- 100074624717
3. R. Kruse, C. L. Tondo, B. P. Leung, Data Structures and Program Design, Third Edition, Pearson Education, 1999. ISBN 81-203-0884-0. Reprint 2006.
4. A. V. Aho, J. E. Hopcroft, and J. D. Ullman, "Data Structures and Algorithms", Pearson Education, First Edition Reprint 2003.Fourth impression,2009, ISBN 978-81-7758-826-2

5. S. Tanenbaum, Y. Langsam, and M. J. Augenstein, Data Structures Using C and C++, Second Edition, PHI/Pearson Education, 1996. ISBN 978-81-203-1177-0.
6. Mark Allen Wiss, Data Structures and Algorithm Analysis in C++, Third Edition, Addison Wesley, 2006. ISBN: 032144146X.Third Impression 2009

14CS2010 DATA STRUCTURES LAB

Co-requisite: 14CS2009 Data Structures

Credits: 0:0:2

Objective:

- To develop skills to design and analyze simple linear and non linear data structures
- To strengthen the ability to identify and apply the suitable data structure for the given real world problem
- To gain knowledge in practical applications of data structures

Outcome:

The student will be able to

- design and analyze the time and space complexity of the data structure
- identity the appropriate data structure for a given problem
- have practical knowledge on the application of data structures

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2011 DATABASE SYSTEMS

Credits: 3:0:0

Objective:

- To provide an introduction to how to manage the databases
- To emphasize the fundamentals of relational systems including data models, database architectures, and database manipulations.
- To provide an understanding of new developments and trends such as Internet database environment and data warehousing.

Outcome:

The student will be able to

- understand database performance issues.
- understand the basics of data management and administration.
- evaluate the normality of a logical data model, and correct any anomalies.
- retrieve data using SQL.
- understand the basics of data warehousing.
- work as a valuable member of a database design and implementation team.

Introduction to Database Management Systems – ER- model, Relational model, Query Languages – SQL and Advanced SQL, Triggers, Database Design and E-R Model –Designing database for practical applications – Database System Architecture, Relational Database Design – Normal forms – studying the impact of different normalization forms for practical applications - Modeling Temporal Data, Storage and File Structure - sequential files, indexing, B and B+ trees - different file Transactions and concurrency control - Case Study : Implementation of different indexing techniques in DBMS – Development of a database application program.

Reference Books:

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, Fifth Edition, Mc Graw-Hill International, 2006. ISBN 007-124476-X.
2. Ramez Elmasri, Durvasula V. L. N. Somayajulu, Shamkant B. Navathi and Shyam K. Gupta, Fundamentals of Database Systems, Pearson Education, 2006. ISBN 81-7758-476-6.
3. Garcia Molina, DataBase Systems:The Complete Book, Third Impression,2009,ISBN 978-81-317-0842-2.
4. Ramez Elmasri, Fundamentals of Database Systems, Pearson Education India, 2008, ISBN : 8131716252
5. Raghu Ramakrishnan, Johannes Gehrke, Database Management Systems, McGraw-Hill Education, 2003, ISBN: 0072465638

14CS2012 DATABASE SYSTEMS LAB

Co-requisite: 14CS2011 Database Systems

Credit: 0:0:2

Objective:

- To provide an introduction to Query Language
- To emphasize the fundamentals of DDL, DML DCL and TCL.
- To provide an understanding of new developments and trends in developing a database.

Outcome:

The student will be able to

- create database.
- analyze the basics of data management and administration.
- evaluate the normality of a logical data model, and correct any anomalies.
- retrieve data using SQL.
- create views and handle exceptions.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2013 MACHINE LEARNING PRINCIPLES AND APPLICATIONS

Credits: 3:0:0

Objective:

- To understand the concepts of machine learning algorithms
- To understand the performance and limitations of various machine learning algorithms
- To explore how machine learning algorithms can be applied to various applications
- To provide hands-on experience in machine learning tools

Outcome:

The student will be able to

- understand the techniques, mathematical concepts, and algorithms of machine learning
- select the appropriate machine learning algorithm to solve any practical problem
- get an insight into different aspects of machine learning like data preprocessing, data selection, classification, clustering
- preprocess the data and efficiently execute the algorithm to solve the problem
- analyze and compare the results of different machine learning algorithms
- understand the statistical techniques to analyze the results

Introduction – Examples of Machine Learning Applications-Supervised Learning -Bayesian Decision Theory -Parametric Methods -Multivariate Methods-Dimensionality Reduction -Clustering - k-means clustering, hierarchical clustering,

distributional clustering - Nonparametric Methods -Decision Trees -Linear Discrimination-Multilayer Perceptrons -Local Models-Kernel Machines -Bayesian Estimation-Hidden Markov Models-Graphical Models -Combining Multiple Learners - Reinforcement Learning-random forests-Design and Analysis of Machine Learning Experiments-Case study

Reference Books:

1. Sushmita Mitra, Sujay Datta, Theodore Perkins and George Michailidis, "Introduction to Machine Learning and Bioinformatics", CRC Press, 2008.
2. Ethem Alpaydin, "Introduction to machine learning", MIT Press, 2010.
3. David Barber, "Bayesian Reasoning and Machine Learning", Cambridge University Press, 2012
4. Stephen Marsland, "Machine Learning: An Algorithmic Perspective", CRC Press, 2011
5. Bishop, C., "Pattern Recognition and Machine Learning". Berlin: Springer-Verlag, 2006
6. Kevin P. Murphy., "Machine Learning: A Probabilistic Perspective", 2012.
7. T. Hastie, R. Tibshirani and J. Friedman., "The Elements of Statistical Learning", Second Edition, Springer, 2009.

14CS2014 AD HOC NETWORKS

Credits: 3:0:0

Objective:

- To familiarize with Ad Hoc networks.
- To develop a comprehensive understanding of Ad Hoc TCP protocols.
- To evaluate the performance of Ad Hoc routing protocols.

Outcome:

The student will be able to

- gain in depth knowledge about Ad Hoc networks.
- evaluate the performance of Ad Hoc routing protocols.
- Get a comprehensive understanding of Ad Hoc TCP protocols.

Introduction of AdHoc Networks- Issues in AdHoc Wireless Networks – AdHoc Wireless Media Access Protocols. Smart Batteries and Battery Characteristics- Effects of Beaconing on Battery Life. Classification of Routing Protocols – Souce Driven Routing –Types-Table Driven Routing-Types. Updating routes in wireless networks-Static and Dynamic routing-Performance Metrics. TCP Over AdHoc – Versions of TCP-TCP Reno-TCP Veno-TCP Vegas. Classification of Multicast Routing Protocols- Proactive and Reactive-types.

Reference Books

1. Charles .E. Perkins, "AdHocNetworking",Pearson Education,2008.
2. C.K.Toh, "Ad Hoc Mobile Wireless Networks-Protocols and Systems", Pearson Education, 2007.
3. Siva Ram Murthy. C and Manoj. B.S, "AdHoc Wireless Networks: Architectures and protocols", Prentice Hall PTR, 2004.
4. SudipMisra, Issac Woungang, Subhas Chandra Misra"Guide to Wireless AdHoc Networks",Springer Verlag London ltd,2009.
5. Jochen Schiller, "Mobile Communications", Addison Wesley Publishers, 2000.

14CS2015 E-COMMERCE

Credits: 3:0:0

Objective:

- To have an awareness about role of IT in business.
- To have knowledge of basic concepts of ecommerce.
- To have in depth knowledge in security and legal issues in ecommerce.

Outcome:

The student will be able to

- identify the type of ecommerce and security mechanism to be used for particular

application.
- build virtual book store based on requirements.

Introduction to E-commerce -Internet and World Wide Web -Client Side Programming-Servlet Fundamentals - Database Connectivity-Session Tracking-Basic Cryptography for enabling e-commerce-Internet Security-Advanced Technologies for e-commerce - Internet Payment Systems-Consumer-oriented e-commerce-Business oriented ecommerce - E-services-Web Advertising and Web Publishing –Step-by-Step Exercises for Building the VBS.

Reference Books:

1. Henry Chan, Raymond Lee, Tharam Dillon and Elizabeth Chang,E-Commerce Fundamentals and Applications, John Wiley and Sons Ltd., 2008.ISBN 978-81-265-1469-4
2. R Kalokota, Andrew V.Winston, Elecronic Commerce-a Managers Guide, Fourth Edition, Pearson Education, 2006. ISBN:81-780-8158-X.
3. ErfanTurban, DaveKing, JaeKyuLee, DennisViehland, Electronic Commerce-A Managerial Perspective, Fourth Edition, Pearson Education,2006, ISBN: 81-780-8362-0.

14CS2016 ENTERPRISE RESOURCE PLANNING LAB

Co requisite: 14CS2017 Enterprise Resource Planning

Credits: 0:0:2

Objective:
- To configure and build OpenERP modules.
- To implement the access control mechanisms and security policies of OpenERP.
- To use advanced views and components in OpenERP.
- To work on OpenERP Workflows.
- To work on how to generate Reports in OpenERP.
- To work on different web services using OpenERP.

Outcome:
The student will be able to
- give solution for the business needs.
- configure and build OpenERP Modules.
- build and personalize OpenERP workflows.
- customize the templates for the business needs.
- generate reports required for the business.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2017 ENTERPRISE RESOURCE PLANNING

Credits: 3:0:0

Objective:
- To study the typical functionalities of ERP.
- To understand the steps and activities in the ERP life cycle
- To learn concepts of reengineering and how to relate it into ERP system.
- To study best business practices in ERP.

Outcome:
The student will be able to
- map business processes using process mapping techniques.
- identify and describe typical functionalities in ERP system

- provide solutions for ERP business needs.

Overview of ERP-Introduction to ERP-Basic Concepts of ERP-Risks and Benefits of ERP-ERP and Related Technologies-ERP Market Place and Marketplace Dynamics- ERP-Functional Modules- ERP Implementation Basics-ERP Implementation Life cycle- Package Selection-Transition strategies, implementation process-ERP Project Teams-Consultants- Vendors and Employees- Success and Failure Factors-Operation and Maintenance-Maximizing the ERP system-ERP and eBusiness- ERP-internet and www-Future Directions and trends - Introduction to OpenERP - ERP Case studies.

Reference Books:

1. Alexis Leon, Enterprise Resource Planning, McGraw Hill Education, Second Edition, Thirteenth reprint 2013, ISBN -13:978-0-07-065680-2
2. Enterprise Resource Planning, Third Edition, Ellen F. Monk, Bret J. Wagner, Cengage Learning EMEA, 2009
3. Enterprise Resource Planning, Mary Sumner, Pearson Education India, 01-Sep-2006
4. Qualitative Case Studies on Implementation of Enterprise Wide Systems, Liisa von Hellens, Sue Nielsen, JenineBeekhuyzen, Idea Group Inc (IGI), 2005
5. Working with OpenERP, By Gregory R Moss, Packt Publishing Ltd, 2013, ISBN 1782163816, 9781782163817

14CS2018 ETHICS IN INFORMATION TECHNOLOGY

Credits: 3:0:0

Objective:

- To understand the development and need for issues regarding social, legal, privacy and the application of computer ethics to information technology.
- To learn professional ethics, privacy, criminal conduct, property rights, free speech, access, and reliability.

Outcome:

The student will be able to

- identify issues of professional conduct in information technology.
- determine the impact of the privacy laws on information security policies.
- understand the issues related to intellectual freedom, intellectual property and copyright law as they relate to electronic publishing.
- identify key ethical concerns of information technology specialists.
- respond to and apply appropriate decisions around ethical issues in an array of information and technology practices.

An Overview of Ethics - Ethics in the Business World-Ethics in IT-Ethics for IT Workers, Users and Professionals-IT professional malpractice - IT Security Incidents - Privacy-Privacy Protection and the Law-Key Privacy and Anonymity Issues - First Amendment Rights-Freedom of Expression-Intellectual Property-Copyrights-Patents-Trade Secrets-Key Intellectual Property Issues - Strategies to Engineer Quality Software-Key Issues in Software Development- the impact of IT on the Standard of Living and Productivity - the impact of IT on Healthcare Costs - Social Networking - Ethics of Information Technology Organizations -ICT Industry Code for Conduct

Reference Books:

1. Ethics in Information Technology, Fourth Edition, by George Reynolds, CENGAGE Learning ,2012, ISBN-9788131518755
2. Case Studies in Information Technology Ethics, Second Edition, by Richard A. Spinello, Prentice-Hall, 2002.ISBN 0130991503
3. A Gift of Fire:social, legal, and ethical issues for computing and the Internet, Second Edition, by Sara Baase, Prentice Hall, 2008, ISBN 0136008488, 9780136008484.
4. Ethics and Technology: Ethical Issues in an Age of Information and Communication Technology, Second Edition by Tavani, H, John Wiley and Sons 2007. ISBN: 978-0-471-99803-7.

14CS2019 MANAGEMENT INFORMATION SYSTEMS

Credits: 3:0:0

Objective:

- To explain the fundamental concepts of information systems in business
- To understand systems approach and know their uses in problem solving
- To realize how organizations are strategically using Information technology
- To know the challenges of analysing and redesigning of information systems

Outcome:

The student will be able to

- Understand the various methods of information systems.
- Get a user-manager perspective on various information systems
- Integrate information theory and practice

Information Systems: A manager's view on Information Systems – An Introduction to concept of systems and organizations – Strategic uses of IT – Business process reengineering and IT - Computer System Resource: Computer hardware, software – File and Database management systems – Communication systems basics – Distributes Systems – The Internet and Office Communications. Applications of Information Systems: Applications of operational IS to business – Applications of tactical and strategic IS to business – Decision support systems and expert systems. Planning and Development of Information Systems: Planning, Systems analysis and design, Alternative application development approaches. The Management of Information Systems: Organization and end user computing – Security and ethical issues.

Reference Books:

1. Robert Schultheis, Mary Sumner "Management Information Systems" McGraw-Hill Education India 22nd Reprint 2013 Edition 1999 ISBN 0-25625195-9
2. James A'O.Brien, Marakas "Management Information Systems" Tata McGraw-Hill Education, Edition, 2006 ISBN-13: 978-0073376813
3. Terry Lucey "Management Information Systems" Ninth Edition, Reprint 2005 © Thomson Learning ISBN-13: 978-1-84480-126-8
4. Ken J. Sousa, Effy Oz "Management Information Systems" Seventh Edition, Cengage Learning 2009 ISBN-13: 978-1285186139
5. Gordon B. Davis, Margrethe H.Olson "Management Information Systems: Concepts, Structure and Management" Second Edition, Tata McGraw-Hill Education 21st Reprint 2008 ISBN-13: 978-0070-40267-6

14CS2020 FUNDAMENTALS OF HUMAN COMPUTER INTERACTION

Credits: 3:0:0

Objective:

- To learn the human computer interaction fundamentals.
- To address the basics of 2D graphics, event handling, widget architecture, layout algorithms and management of multiple views of the same data.
- To study and understand the human physiology on user interface design.

Outcome:

The student will be able to

- design, implement and evaluate effective and usable graphical computer interfaces.
- describe and apply core theories, models and methodologies in the field of Human Computer Interaction.
- learn current research in the field of Human Computer Interaction.
- understand reasoning behind the guidelines and use of the design methods.

Introduction to Interactive Systems – Drawing - Event Handling And Widgets - Layout Constraints - Multiple View Models - Abstract Model Widgets – Look And Feel Interface Design Tools – Internationalization - Input Syntax Specification – 2D Geometry - Geometric Transformations – Interacting With Geometry – Cut, Copy, Paste, Drag And Drop – Undo, Scripts And Version - Distributed And Collaborative Interaction – Text Input - Digital Ink - Selection Input - Presentation Architecture - Web Interaction – Physical Interaction - Functional Design – Evaluating Interaction

Reference Books:

1. Dan R. Olsen, Human – Computer Interaction, Cengage Learning, 2010. ISBN – 13: 978- 81-315-1137-4
2. Alan J. Dix, Janet E. Finlay, Gregory D. Abowd, Russell Beale, Janet E. Finley., Human-Computer Interaction, Third Edition, Prentice Hall, 2004. ISBN– 13: 978-0-13-046109-4
3. Christine Faulkner The Essence of Human-Computer Interaction, First Impression 2011, Pearson Education, ISBN 978-81-317-5675-1
4. Helen Sharp, Yvonne Rogers, Jenny Preece, Interaction Design: Beyond Human Computer Interaction, Second Edition, Wiley, 2007. ISBN-13: 978-0470018668
5. Ben Shneiderman, Maxine Cohen, The user interface-Strategies for Effective Human-Computer Interaction, Fifth Edition, Pearson Education, 2008. ISBN-13: 9780321537355

14CS2021 INFORMATION SECURITY

Credits: 3:0:0

Objective

- To provide with a thorough understanding of the issues associated with the design, provision and management of security services for information systems.
- To learn the different aspects of information security, security attacks and the defense strategies used to combat them.

Outcome

The student will be able to

- describe the fundamental concepts of information system security.
- understand the basic security terms such as encryption, authentication, firewall and intrusion detection.

Introduction to Security-Meaning of Security, Attacks, Types of Computer Crimes, Methods of Defense, Elementary cryptography - Substitution cipher, Transposition cipher- Symmetric and asymmetric Encryption techniques–uses of encryption – Program Security – non malicious program errors – malicious code - Operating Systems Security – Access Control-File Protection mechanisms-User Authentication-Security Policies- Database Security - security requirements- Reliability and Integrity- Protecting sensitive data - Security in Networks Threats and attacks in networks - Networks security control–Firewalls - Intrusion Detection

Reference Books:

1. Charles P. Pfleeger and Shari Lawrence Pfleeger, Security in Computing, Fourth Edition, Pearson Prentice Hall,2007 ISBN-10: 0132390779 ISBN-13: 9780132390774
2. William Stallings, Cryptography and Network Security, Fourth Edition, Prentice Hall, 2006. ISBN: 81-203-3018-8.
3. Bruce Schneier, Applied Cryptography, Second Edition, John Willey and Sons, 2007. ISBN: 8126513683
4. Wenbo Mao, Modern Cryptography, First Edition, Pearson Education, 2008 ISBN: 978-81-317-0212-3
5. Roberta Bragg, Mark Rhodes, Keith Strassberg, Network Security, Tata Mcgraw Hill Edition,2008. ISBN-13: 978-0-07-058671-0
6. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, Second Edition, Prentice Hall, 2002. ISBN: 81-203-2213-4.

14CS2022 INFORMATION SECURITY LAB

Co-requisite: 14CS2021 Information Security

Credits: 0:0:2

Objective:

- To test various cryptographic techniques
- To simulate the various levels of threat available and counteract to it.
- To apply the various security techniques and understand their performance issues and their reliability.

Outcome:

The student will be able to

- have hands on experience on the security aspect of a system.
- judge and deploy the type of security which would be apt for an application.
- have in depth understanding of various cryptographic techniques, security management, and security testing of data in the network.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14IT2023 INFORMATION SYSTEMS STRATEGY PLANNING AND MANAGEMENT

Credits: 3:0:0

Objective:

- To explore the issues and approaches in managing the information systems function in corporate organizations
- To provide a better understanding of the influence of modern technologies on business decisions and the impact of IT on industries, markets, and organizations
- To understand the operational issues at the interface of business and technology
- To highlight the importance of leadership in management of IT activities

Outcome:

The student will be able to

- Understand the various functions and activities within the information systems area.
- Understand the concepts of corporate Information Strategy at the enterprise level.
- Appreciate how Information Strategy represents a key source of competitive advantage for corporate firms.
- Understand existing and emerging information technologies, its functions and its impact on the organizational operations.
- Apply information to the needs of different industries and areas.

IT and strategy – IT and organization: The need, Information, Organization and Control - Extending the Enterprise: Understanding Business Networks, Hybrid Governance Models, Building Collaborative Community – Business Case for IT - Understanding Internetworking Infrastructure – Assuring Reliable and Secure IT Services - Managing Diverse IT Infrastructures – Organizing and Leading the IT function - Managing IT Outsourcing – A Portfolio approach to Managing IT projects

Reference Books:

1. Lynda Applegate, Robert D Austin, FWarren McFarlan, “Corporate Information Strategy and Management: Text and Cases" McGraw-Hill Education (India) Edition 2007 ISBN-13:978-0-07-063584-5 ISBN-10: 0-07-063584-6
2. Anita Cassidy, “A Practical Guide to Information Systems Strategic Planning”, 2nd edition, Auerbach Publications 2006 Taylor and Francis Group ISBN 0-8493-5073-5

3. Steve Clark, "Information Systems Strategic Management, An Integrated Approach" Routledge 2007 Taylor and Francis Group, ISBN 978-0415-38186-4
4. Kevin Grant, Ray Hackney, David Edgar "Strategic Information Systems management" 2010 Cengage Learning EMEA, ISBN 978-1-4080-0793-8
5. John Ward and Joe Peppard "Strategic Planning for Information Systems" John Wiley and Sons Limited, 3rd edition, 2002 ISBN 0470-841-478

14CS2024 INTELLIGENT SYSTEMS

Credits: 3:0:0

Objective:

- To introduce the basic concepts of artificial intelligence.
- To introduce new approaches to solve a wide variety of research-oriented problem.

Outcome:

The student will be able to

- understand the problem spaces and search techniques
- form rules and reasoning

Introduction to Intelligent Systems – Problems, Problem Spaces, and Search – Heuristic Search Techniques-Knowledge Representation Issues –Predicate Logic-Representing Knowledge Using Rules – Symbolic Reasoning under Uncertainty–Statistical Reasoning-Weak Slot-and–Filler Structures - Strong Slot-and-Filler Structures – Knowledge representation Summary-Learning : Expert Systems, Neural Nets Learning, Genetic Learning.

Reference Books:

1. Elaine Rich, Kevin Knight, Shivashankar B. Nair, Artificial Intelligence, Third Edition, McGraw-Hill, 2009. ISBN -13: 973-0-07-008770-5. ISBN-10:0-07-008770-9
2. Stuart Russell, Peter Norvig, Artificial Intelligence: A Modern Approach, Third Edition, Prentice Hall, 2010.
3. Nils J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier-Morgan Kaufmann, 2011.
4. Dan W.Patterson, "Introduction to Aritificial Intelligence and Expert Systems", Prentice Hall India, 2010.
5. David Poole and Alan Mackworth," Artificial Intelligence: foundations of computational agents", Cambridge University Press, 2010.
6. Al-Dahoud Ali ,"Computational Intelligence and Modern Heuristics" , InTech , 2010

14CS2025 IT INFRASTRUCTURE AND MANAGEMENT

Credits: 3:0:0

Objective:

- To explain how IT infrastructure components work on an architectural level
- To explain the main architectural building blocks and concepts
- To describe each infrastructure component and their specific performance, availability and security concepts.
- To concentrate on other parts of the infrastructure, like datacenters, storage, and servers as well.

Outcome:

The student will be able to

- Acquire a wealth of information about IT infrastructures
- Understand infrastructures and how to build more reliable, faster applications that are better manageable.
- Recognize crucial architectural decisions and principles in an infrastructure and ways to deal with them
- Get more insight in to the tasks and way of working of infrastructure architects

Infrastructure Management Overview – IT infrastructure – Non-functional attributes – Availability Concepts – Performance Concepts – Security Concepts – Datacenters – Servers – Networking – Storage – Virtualization – Operating Systems – End User

Reference Books:

1. Sjaak Laan, "IT Infrastructure Architecture - Infrastructure Building Blocks and Concepts Second Edition, Lulu Press Inc., Second Edition 2013 ISBN 978-1-29125079-4
2. Phalguni Gupta, Surya Prakash, Umarani Jeyaraman, "IT Infrastructure and its Management" Tata McGraw-Hill Education (India) Edition 2009, ISBN 978-0-07-068184-2
3. Foundations of IT Service Management: based on ITIL, by Jan Van Bon, Van Haren Publishing, 2nd edition 2005
4. Manoj Kumar Choubey, Saurabh Singhal, "IT Infrastructure and Management" Pearson Education, 2012, ISBN:9788131767214
5. Harris Kern, Stuart D. Galup, Guy Nemiro, "IT Organization: Building A World-class Infrastructure" Prentice Hall,ISBN-13: 978-0130222985
6. Rich Schiesser "IT Systems Management: Designing, Implementing, and Managing World-Class Infrastructures", Prentice Hall PTR, 2001

14CS2026 JAVA PROGRAMMING LAB

Co-requisite: 14CS2040 Programming in Java

Credit: 0:0:2

Objective:

- To implement the Java programming language fundamentals: its syntax, idioms, patterns, and styles.
- To implement object oriented programming concepts.
- To learn the essentials of the Java class library.

Outcome:

The student will be able to

- understand the format and use of objects.
- understand the basic input/output methods and their usage
- understand object inheritance and its usage
- understand development of JAVA applets and JAVA applications.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2027 INTERNET ROUTING ARCHITECTURE

Pre-requisite: 14CS2007 Computer Networks

Credits: 3:0:0

Objective:

- To provide knowledge in direct interconnections, Routing arbiter project, Regional providers, Information services.
- To understand the ISP services, ISP backbone selection criteria, Demarcation point.
- To gain in-depth knowledge in Variable-length subnet masks (VLSMs), Private addressing and NAT and IP version 6 (IPv6).

Outcome:

The students will be able to

- gain practical addressing, routing, and connectivity issues both conceptually and in the context of practical scenarios
- foster their understanding of routing to plan and implement major network designs in an objective and informed way.
- address the routing challenges faced in the network.

The Contemporary Internet: ISP Services and Characteristics, IP Addressing and Allocation Techniques, Routing Protocols: Inter-domain Routing Basics, Border Gateway Protocol (BGP) Version 4, Effective Internet Routing Designs: Tuning BGP Capabilities, Redundancy, Symmetry, and Load Balancing, Controlling Routing Inside the Autonomous System, Designing Stable Internets, Internet Routing Device Configuration: Configuring Basic BGP Functions and Attributes, Configuring Effective Internet Routing Policies

Reference Books:

1. Sam Halabi, "Internet Routing Architectures" 2nd edition, 2000, Cisco Press, ISBN:978-1578702336
2. Randy Zhang, Micah Bartell, "BGP Design and Implementation", 1st edition, 2003, Cisco Perss, ISBN: 978-1587051098
3. Iljitsch van Beijnum, "BGP- Building Reliable Networks with the Border Gateway Protocol" 2002, O'Reilly, ISBN: 978-0596002541
4. Christian Huitema, "Routing in the Internet", 2000, Prentice Hall, ISBN: 978-0130226471
5. Doyle, Jeff and Carroll, Jennifer, "Routing TCP/IP, Volume I", 2nd edition, 2005, Cisco Press, ISBN: 1-58705-202-4.

14CS2028 SOFTWARE ENGINEERING LAB

Co-requisite: 14CS2042 Software Engineering

Credit: 0:0:2

Objective:

- To understand the software engineering development lifecycle
- To develop a software by understanding systematic software development procedure.

Outcome:

The student will be able to

- design and develop an application by following the software engineering principles.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2029 MOBILE APPLICATION DEVELOPMENT LAB

Co-requisite: 14CS2063 Mobile Application Development using Android

Credits: 0:0:2

Objective:

- To learn the platform, tools and technology and process for developing mobile applications using Google Android.
- To get exposure about file system, multimedia, database and connectivity in the Android operating system.

Outcome:

The student will be able to

- have a clear understanding of the creation and use of simple user interfaces.
- use tools to create applications for a mobile platform.

- create simple graphics for mobile devices.
- appropriately use different types of networking options for mobile devices.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2030 MULTIMEDIA SYSTEMS AND DESIGN

Credits: 3:0:0

Objective:

- To present a step-by-step approach to multimedia systems design.
- To introduce multimedia standards and compression and decompression technologies.
- To provide a detailed analysis of the various storage technologies.

Outcome:

The student will be able to

- understand different realizations of multimedia tools and their usage.
- implement various multimedia standards and compression technologies.
- analyze various storage technologies.

Introduction to Multimedia systems design – Multimedia Systems Architecture – Evolving technologies for Multimedia –- Multimedia Databases - Compression and decompression-Types of compression –Video Image compression – Video Image Compression - Audio compression – Fractal Compression - Multimedia input/output technologies- Key Technology Issues — Image scanners - Digital Voice and Audio – Video images and animation – Full-motion video - Storage and retrieval technologies-Magnetic Media Technology – Optical Media – Hierarchical Storage management – Cache management for storage systems - Multimedia application design-Multimedia Application classes – Types of Multimedia systems — Application workflow design issues – Distributed application design issues.

Reference Books:

1. Prabhat K Andleighand KiranThakrar, Multimedia Systems and Design, PHI, 2009.
2. Tay Vaughan, Multimedia Making it work, Fourth Edition, Tata McGraw-Hill. ISBN: 0-07-463953-6.
3. Ze-Nain Li, Mark S.Drew, Fundamentals of Multimedia, PHI, ISBN :81-203-2817-5.
4. John F. Koegel Buford, Multimedia Systems, Third Edition, 2009, ISBN: 978-81-7758-827-9.
5. Gaurav Bhatnager, Shikha Mehta, SugataMitra, Introduction to Multimedia Systems, First Edition, 2004. ISBN: 0125004524.

14CS2031 SERVICE ORIENTED ARCHITECTURE

Credits: 3:0:0

Objective:

- To provide an introduction to service-oriented architectural (SOA) model and the service-orientation design paradigm and their services.
- To explore the possibilities of incorporating existing services for new applications and for automating business processes.

Outcome:

Student will be able to

- Understand how SOA systems differ from traditional non-distributed systems
- Understand the impact of SOA on business, software quality, efficiency, security, performance and flexibility.
- Develop program logic for Web Service systems.

Introduction to SOA with Web Services-Overview of Service Oriented Architecture - SOA and Web Services- SOA and web Services for Integration- SOA and multi-channel access-SOA and Business Process Management-Metadata management – Web Services Security– Advanced Messaging –Transaction Processing.

Reference Books:

1. Eric Newcomer and Greg Lomow, Understanding SOA with Web Services, Pearson Education India, New Delhi, 2005.ISBN:10:0321180860.
2. Michael P. Papazoglou, Web Services and SOA: Principles and Technology , Second Edition,Pearson Prentice Hall , 2011, ISBN 10: 0273732161 ,ISBN 13:9780273732167.
3. Michael Bell, Service-Oriented Modeling (SOA): Service Analysis, Design, and Architecture, Wiley, 2008. ISBN-10: 0470141115
4. Thomas, Erl, Service-Oriented Architecture: Concepts, Technology, and Design, Prentice Hall 2006, ISBN: 0-13-185858-0.
5. Barry Douglas K, Web Services and Service oriented Architectures- The Savvy Manager's Guide, Morgan Kaufmann Publishers, USA, 2013.ISBN: 0123983576,ISBN-13:978-0123983572

14CS2032 NETWORK SECURITY LAB

Co-requisite: 14CS2008 Cryptography and Network Security

Credits: 0:0:2

Objective

- To facilitate the students to implement various cryptographic algorithms.
- To implement various principles of cryptosystems.

Outcome:

The student will be able to

- put into practice the various symmetric and asymmetric key algorithms.
- understand the importance of network security.
- handle different kinds of attacks

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2033 NETWORKING LAB

Co-requisite: 14CS2007 Computer Networks

Credits: 0:0:2

Objective:

- To provide hands-on experience to students on various networking topologies, protocols, routing protocols, wireless communication technologies.
- To simulate some networking applications.

Outcome:

The student will be able to

- implement TCP/IP Protocols and routing Protocols.
- simulate networking topologies and wireless communication technologies

The faculty conducting the Laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2034 OBJECT ORIENTED ANALYSIS AND DESIGN

Credits: 3:0:0

Objective:

- To learn the object oriented software development basics.
- To learn the various issues in modeling the object oriented applications using Unified Modeling Language and the various techniques proposed by Grady Booch,Jim Rambaugh and Ivar Jacobson.
- To study and use the various approaches to identify the classes, attributes, methods and relationships.
- To understand the various layers of object oriented applications

Outcome:

The student will be able to

- design and model the object oriented applications using Unified Modeling Language.
- model the requirements with use cases.
- describe and define the dynamic structure and behavior of a system

Object Basics-Object Oriented Development Life Cycle-Software Development Process, Rambaugh, Jacobson and Booch Methodologies-Unified Approach-Unified Modeling Language, Use case driven object oriented analysis-Classification Theory-Various Approaches to identify classes, attributes, responsibilities and relationships-Design axioms and corollaries-case studies, Refine attributes, methods and relationships-Layered approach of object oriented application design-case studies

Reference Books:

1. Ali Bahrami, Object Oriented Systems Development using the Unified Modelling Language, McGraw Hill, Second Reprint 2008, ISBN:978-0-07-026512-7
2. Grady Booch, Object Oriented Analysis and Design With Applications, Addison Wesley, Third Edition, September 2009, ISBN 978-81-317-2287-9
3. Simon Benett, Object Oriented Analysis and Design Using UML, Third Edition, Publication Date: August 1, 2005 | ISBN-10: 0077110005 | ISBN-13: 978-0077110000
4. Atul Kahate, Object Oriented Analysis And Design, First Edition, McGraw-Hill, 2004. ISBN:0070583765.
5. Joseph Schmuller, UML, Third Edition, Pearson Education, 2004. ISBN: 81-297-0609-1.

14CS2035 OBJECT ORIENTED PROGRAMMING IN C++

Credits: 3:0:0

Objective:

- To teach the students how to write high quality, internally documented, well structured C++ program.
- To enable the students to learn how C++ supports Object Oriented principles such as abstraction, information hiding, localization and modularity, and how to apply these principles in software development.

Outcome:

The student will be able to

- identify the major elements in an object-oriented programming language.
- implement operator overloading and use inheritance in C++.
- select the proper class protection mechanism.
- demonstrate the use of virtual functions to implement polymorphism.
- understand the advanced features of C++ including templates, exceptions, and multiple inheritances.

Introduction to object oriented concepts - C++ Programming Basics – Data Types – i/o statements – operators-Loops and Decisions – Debugging of Simple C++ Program – Structures - Functions - Application Development using Structure and Control Statements - Objects and Classes - Arrays and Strings – Real Time Application using Objects and Arrays - Operator Overloading- Inheritance-Pointers – Application Development using Inheritance and

Polymorphism - Virtual Functions- Streams and Files- Templates and Exceptions – Real Time Application using Files, Streams and Templates with Error Handling

Reference Books:

1. Robert Lafore, Object Oriented Programming in C++, Fourth Edition, Tech Media, 2008. ISBN 0-672-32308-7.
2. Herbert Schildt, *C++:* The Complete Reference, Fourth Edition, Tata McGraw-Hill, 2009.Reprint, ISBN 0-07-053246-X.
3. Joyce Farrell, Object-Oriented Programming Using C++, Fourth Edition, Cengage Learning, 2008, ISBN 9781423902577
4. Paul J. Deitel, Harvey M. Deitel , C++: How to Program, Prentice Hall, 2010, ISBN 9780136117261
5. Bjarne Stroustrup, Programming Principles and Practice using C++", Addison Wesley, Pearson Education 2009, ISBN: 978-0321543721.

14CS2036 OBJECT ORIENTED PROGRAMMING IN C++ LAB

Co -requisite: 14CS2035 Object Oriented Programming in C++

Credits: 0:0:2

Objective:

- To write high quality program, internally documented, well structured C++ program
- To learn the programming methodology, how C++ supports object oriented principles
- To provide solution for apply these principles in software development.

Outcome:

The student will be able to

- identify the major elements in an object-oriented programming language.
- implement Constructors, Static and constant members in C++
- implement operator overloading and use inheritance in C++.
- select the proper class protection mechanism.
- implement Friend function and Virtual function in C++

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2037 OPERATING SYSTEM

Credits: 3:1:0

Objective:

- To gain knowledge about the operating systems concepts such as process, main memory management, secondary memory management, CPU and disk scheduling.

Outcome:

The student will be able to

- understand the architecture of operating system including kernel.
- understand the issues in designing an operating system.

Operating System Introduction- organization of computer System Structure- Operating System Structure-Process Management- Processes – Threads – CPU Scheduling -Synchronization and Memory Management- Process Synchronization – Deadlocks- Main Memory andVirtual Memory Management strategies - File Management - File-System Interface - File-System Implementation-Secondary Storage Management - I/O Systems.

Reference Books:

1. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles,Seventh Edition, John Wiley and Sons, 2006. ISBN: 9812-53-176-9.
2. D. M. Dhamdhere, Operating Systems, Second Edition, Tata McGraw-Hill Education (India), 2006. ISBN: 0070611947.
3. Achyut S. Godbole Operating Systems With Case Studies in Unix Netware Windows NT, Tata McGraw-Hill, 2005. ISBN: 007059113X, 9780070591134.
4. Andrew S. Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall, 2008.ISBN 0136006639, 9780136006633
5. Pramod Chandra P. Bhatt, An Introduction to Operating Systems: Concepts and practice,PHI Learning Pvt. Ltd., 2007. ISBN: 978-8120332584.
6. Colin Ritchie Operating Systems Incorporating UNIX and Windows: Incorporating Unix and Windows, Fourth Edition, Thomson Learning EMEA, Reprint 2006. ISBN: 0826464165, 9780826464163.
7. Paul J. Deitel, David R. Choffnes, Operating Systems, Third Edition, Prentice Hall, 2004, ISBN: 978-0131246966

14CS2038 PRINCIPLES OF COMPILER DESIGN

Pre-requisite: 14CS2047 Theory of Computation

Credits: 3:0:0

Objective:

- To introduce the major concept areas of language translation and compiler design.
- To develop an awareness of the function and complexity of modern compilers.
- To provide practical, hands on experience in compiler design.

Outcome:

The student will be able to

- develop a fundamental understanding of various stages of compiling.
- develop a firm and enlightened grasp of concepts learned earlier in their study like higher level programming, assemblers, automata theory and formal languages, data structures, algorithms and operating systems.
- design a compiler for a concise programming language.

Introduction to Compiler - The Structure of a compiler -Lexical Analysis (scanner): Regular Language, Finite Automata, Regular Expression, Regular Expression to Finite Automata, Lexical-Analyzer Generator (LEX)-Syntax Analysis (Parser): Context-Free Grammar, Top-Down Parsing, LL(1) Grammar, Bottom-Up Parsing, LR Parsers, Parser Generator (YACC)-Semantic Analysis: Syntax Directed Definition, Evaluation Orders for SDD's, Syntax-Directed Translation Schemes, Run-time environment: Storage Organization, Stack Allocation of Space - Intermediate Code Generation: Different Types of Intermediate Forms, Types and Declarations, Translation of Expressions, Type Checking, Control Flow-Code Generation and Optimization: Issue in the Design of a Code Generator, Optimization of Basic Blocks, Peephole Optimization, Principal Sources of Optimization, Data-Flow Analysis.

Reference Books:

1. Alfred V. Aho, Monica S.Lam, Ravi Sethi, Jeffrey D.Ullman, Compilers : Principles, Techniques and Tools, Second Edition, Pearson Education, 2008.
2. K.D. Cooper, and L. Torczon, Engineering a Compiler, Elsevier, 2012, ISBN: 978-0-12-088478-0
3. Dick Grone, Kees van Reeuwijk, Henri E Bal, Ceriel J H Jacobs, and Koen G Langendoen, Modern Compiler Design, John Wiley and Sons, Second Edition, 2012. ISBN: 978-1-4614-4699-6
4. Allen I. Hollub, Compiler Design in *C*, PHI Learning, 2009. ISBN: 978-8120307780
5. David Galles, Modern Compiler Design, Pearson Education 2009, ISBN-10:8131709418

14CS2039 COMPUTER GRAPHICS AND APPLICATIONS LAB

Co-requisite: 14CS2006 Computer Graphics, 14MT2040 Computer Animation

Credits: 0:0:2

Objective:

- To make students aware of the concepts underlying modern Computer Graphics and Animation.
- To get a firm grasp of animation for 3D.
- To understand timing and movement.
- To learning how to light and render a scene.

Outcome:

The student will be able to

- understand contemporary graphics hardwares.
- create interactive graphics applications in C++ using one or more graphics application programming interfaces.
- have an in depth knowledge about the functions to implement graphics primitives.
- design, present, defend, and execute an animation.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2040 PROGRAMMING IN JAVA

Credits: 3:0:0

Objective:

- To learn the Java programming language fundamentals: its syntax, idioms, patterns, and styles.
- To learn object oriented programming concepts.
- To learn the essentials of the Java class library.

Outcome:

The student will be able to

- understand the format and use of objects.
- understand basic input/output methods and their use.
- understand object inheritance and its use.
- understand development of JAVA applets and JAVA applications.
- understand the use of various system libraries.

Introduction to Java , Data Types ,Arrays , control statements – Debugging Java Program, Classes, Inheritance, Packages, Interfaces and Exception Handling – Desktop Application development using Classes and Inheritance with Exception Handling - Multithreading, Enumeration, Autoboxing, Annotation and Generics – Application Development using Multithreading with Generics - String Handling, Input/Output, Networking and Applet – Distributed Application using Applet - Event Handling and AWT – Layout Managers – Application Development using GUI.

Reference Books:

1. Herbert Schildt, Java - The Complete Reference, Tata McGraw- Hill, Seventh Edition, 2008.ISBN 13: 978-0-07-063677-4
2. Kathy Sierra, Bert Bates, Head First Java, Second Edition, O'Reilly Media, 2005. ISBN: 10-0596004656, ISBN-13:9780596004651.
3. Harvey M. Dietel, Java How to Program, Seventh Edition, Prentice Hall, 2007. ISBN:10-0132222205, ISBN:13-978-0132222204
4. Bruce Eckel, Thinking in Java, Fourth Edition, Prentice Hall, 2006. ISBN: 978-0131872486.

5. Ken Arnold, James Gosling, David Holmes, The Java Programming Language, Fourth Edition,Prentice Hall Professional Technical Reference, 2005. ISBN-13:9780321349804
6. E. Balagurusamy, Programming with Java: A primer, Third Edition, Tata McGraw-Hill, 2007.

14CS2041 IP TV AND INTERNET VIDEO

Pre-requisite: 14CS2007 Computer Networks

Credits: 3: 0: 0

Objective:

- To provide an overview of hardware, software, and Internet technologies.
- To introduce key trends and drivers transforming the world of broadcast television and the web

Outcome:

The student will be able to

- Understand the functionalities of IP Protocol and IPTV.
- Learn how IPTV technology delivers TV, Voice home phone service through high speed Internet Connection and Various Video Compression Techniques.

Introduction- The Internet Protocol-The Market for IP Video-Types of IP Video-Business Models-Network Overviews-IP-Video compression-Maintaining Video Quality and Security-Sizing Up Servers-Importance of Bandwidth-Set Top Boxes-Internet Video technologies -The Future of IP Video.

Reference Books:

1. Wes Simpson and Howard Greenfield, IPTV and Internet Video: Expanding the Reach of Television Broadcasting, Focal Press, 2007. ISBN: 978-0-240-81245-8.
2. Howard J. Gunn, The Basics of IPTV, Intl. Engineering Consortium, 2007, ISBN 9781931695589.
3. Gerard O'Driscoll, Next Generation IPTV Services and Technologies, Wiley-Interscience,2007, ISBN: 0470163720
4. Gilbert Held, Understanding IPTV, CRC Press, 2006. ISBN: 0849374154
5. Wes Simpson, Video over IP, Focal Press, 2008.ISBN:978-0-240-81084-3.

14CS2042 SOFTWARE ENGINEERING

Credits: 3:0:0

Objective:

- To learn different life cycle models
- To learn requirement dictation process
- To learn analysis modeling and specification
- To learn architectural and detailed design methods
- To learn implementation and testing strategies
- To learn verification and validation techniques
- To learn project planning and management.

Outcome:

The student will be able to

- understand all the software lifecycle models
- identify the various requirements in a system and to validate them
- understand the various architectural design methods
- implement various testing strategies in a system
- understand various quality measurements for a software system

Introduction to software engineering- A Generic View of Process – Process Models The Unified Process– Agile view of process- Software Project Estimation- Project Scheduling- Risk management-Requirement analysis- The Requirements Engineering Process- Requirements Engineering- Use Cases- Data modeling concepts-Software Design**:-** Design Concepts – Design Models-Software Testing-Strategic approach to software testing-Strategic Issues-SCM and Quality Assurance- SCM Process- Formal Approach To SQA

Reference Books:

1. Roger Pressman.S., Software Engineering: A Practitioner's Approach, Sixth Edition,McGraw- Hill, 2005, ISBN: 007-124083-7.
2. Sommerville, Software Engineering, Eighth Edition: Addison Wesley, 2007. ISBN: 032-131379-8.
3. Carl Dichter, Mark Pease, Software Engineering with Perl, Prentice Hall, 2007. ISBN:013-016965-X.
4. James F Peters, Witold Pedryez, Software Engineering-An Engineering Approach, John Witold Pedrycz, ISBN 10: 0471189642 / ISBN 13: 9780471189640, Wiley publication.
5. P. Fleeger, Software Engineering, Fourth Edition, Prentice Hall, 2009. ISBN-10: 0136061699
6. Carlo Ghezzi, Mehdi Jazayari, Dino Mandrioli, Fundamentals of Software Engineering, Third Edition, PHI, Ninth Indian Reprint,2005

14CS2043 VIRTUALIZATION

Credits: 3:0:0

Objective:

- To learn about desktop, server, network and storage virtualization.
- To be familiar about various applications and use cases of different virtualization techniques.

Outcome:

Student will be able to

- install configure and use virtual machines.
- install and configure virtualization hypervisors.
- create data centers, clusters, pools and templates using virtualization manager.
- perform essential management tasks.

Examining the anatomy of a virtual machine – Preparing a virtual machine host – Installing VM applications on desktops – Deploying VMs on the desktop - Virtualization – Managing CPUs, memory, storage, networking for a virtual machine – Copying, Backing up and recovering virtual machines – Using virtual file systems Sever Virtualization - Types – Business cases for Sever - Design of Scalable Enterprise Networks - Design of Scalable Enterprise Networks - Control-Plane Virtualization – Introducing storage networking – Virtualizing storage – The virtualized information system

Reference Books:

1. Virtualization Essentials, Matthew Portnoy , John Wiley and Sons, Inc.,2012.
2. Virtualization: From the Desktop to the Enterprise, Chris Wolf, Erick M Halter, Apress, 2005-5-26
3. Demystifying the Virtual Desktop, Michael Fox, Createspace, 2010-10-30.
4. Desktop Virtualization, Frederic P Miller, Agnes F Vandome, John Mc Brewster, Alphascript Publishing, 2009-12-31.
5. Desktop Virtualization: What you Need to Know For IT Operations Management, Michael Johnson, Tebbo, 2011.

14CS2044 INTRODUCTION TO SYSTEM ADMINISTRATION

Pre-requisite: 14CS2050 Unix Architecture

Credits: 3:0:0

Objective:

- To guide through the basics of Linux Technology and to train as a System Administrator to maintain a Linux Server.
- To familiarize Kernel Components and System Management.
- To establish a Network and Secure Network Services.

Outcome:

The student will be able to

- gain in-depth knowledge on the working of Linux systems
- work on Linux system and to locate additional utilities, configurations and maintenance.
- demonstrate a working knowledge of networking terms and concepts pertaining to system administration.

Introducing Linux -Exploring the Desktop - Using the Bash Shell - Understanding Users and File systems - Understanding Text Processing - Managing Processes - Using Network Clients-Installing Linux-Understanding System initialization - Managing Packages and File Systems- Managing Users - Configuring Networks- System and Kernel Management- Writing Shell Scripts- Advanced configuration and Troubleshooting.

Reference Books:

1. Nicholas Wells, The Complete Guide to LINUX System Administration, Indian Edition, Cengage Learning, 2005.
2. Evi Nemeth, Garth Snyder, Trent R. Hein , Linux administration handbook, Second Edition, Pearson Education, 2007, ISBN 0-13-148004-9.
3. Tom Adelstein, Bill Lubanovic, Linux System Administration, O'Reilly Media Inc., First Edition, 2007, ISBN -13:978-0-596-00952-6.
4. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley,Unix and Linux System Administration handbook, Fourth Edition 2010, Pearson Education, ISBN 0132117363
5. Terry Collings, Kurt Wall, Red Hat Linux Networking and System Administration, Third Edition, Wiley India(P) Ltd., Reprint 2008, ISBN 81-265-0655-5

14CS2045 SYSTEM SOFTWARE

Credits: 3:0:0

Objective:

- To view some of the major tasks of the system software of a computer system.
- To understand internal working of the hardware and software interface of a typical system.
- To learn about the working of assembler, loaders, and macro-processors.

Outcome:

The student will be able to

- understand the various system software concepts.
- learn and gain knowledge of different system software architectures.
- understand the basic assembler, loaders, macro-processors functions.

Introduction to system software– System Software and Machine Architecture – The Simplified Instructional Computer (SIC) – Traditional (CISC) Machines – RISC Machines – Assemblers: Basic Assembler Functions – Machine Dependent and Independent Assembler Features – Assembler Design Options – Case study - Assembler-Loaders and linkers : Basic Loader Functions – Machine Dependent Loader Features – Machine-Independent Loader Features – Loader Design Options – Case Study : loader - Macro Processors**:** Basic Macro Processor

Functions – Machine-Independent Macro Processor Features– Macro Processor Design Options – Case study - Macro Processor – Text Editors – Interactive Debugging Systems

Reference Books:

1. L. Beck, System Software, An Introduction to System Programming, Addison Wesley, Third Edition 2007. ISBN: 978-81-7758-555-1.
2. D. M. Dhamdhere, Systems Programming and Operating Systems, Tata McGraw-Hill Company, 2009. ISBN: 9780074635797.
3. John J. Donovan, Systems Programming, Tata McGraw Hill-Edition, 2009. ISBN:9780074604823
4. D. M. Dhamdhere, Operating Systems: A Concept-based Approach, Third Edition, Tata McGraw-Hill, 2012. ISBN 9781259005589

14CS2046 SYSTEM SOFTWARE AND COMPILER LAB

Co-requisite: 14CS2038 Principles of Compiler Design

Credit: 0: 0: 2

Objective:

- To design system software and compiler concepts
- To simulate loader, assembler, macro processor and few phases of the compiler.

Outcome:

The student will be able to

- design and develop system processing components such as macro processor, assembler, loader, etc.
- program using various compiler construction tools.
- understand the working of various phases of compiler
- simulate the theoretical machines such as NFA, DFA, etc.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2047 THEORY OF COMPUTATION

Pre-requisite: 14MA2010 Discrete Mathematics

Credits: 3:1:0

Objective:

- To understand the logical and mathematical foundations of computer science.
- To study abstract models of computation.

Outcome:

The student will be able to

- define and use abstract models of computation such as finite and push-down automata, and analyze their relative expressive power.
- define, use, and convert between abstract machine models and formal languages.
- obtain the knowledge of the power and inherent limitations of algorithmic computation.

Finite Automata and Regular Languages: Introduction to Finite Automata, Regular Languages and Regular Grammars, Properties of Regular Languages - Context Free Grammers and Languages: Context Free Languages, Context Free Grammars and their Parse Trees, Simplification of Context Free Grammars and Normal Forms -Push Down Automata: Definition and Languages of A PDA, Deterministic and Nondeterministic Pushdown Automata,

Equivalence Of PDA's and CFG's, Properties of Context Free Languages-Turing Machines: Definition of a Turing Machine, Turing Machine as Language Acceptor and Transducers, Variations of Turing Machines, Linear Bounded Automata - Undecidability: Recursive And Recursively Enumerable Languages, Undecidable Problems about Turing Machines, Post's Correspondence Problem, Overview of Computational Complexity

Reference Books:

1. Peter Linz, An Introduction to Formal Languages and Automata, Fifth Edition, Jones and Bartlett Learning, 2011. ISBN-978-93-808-5328-4
2. John E. Hopcroft, Rajeev Motwani, Jeffrey D. Ullman, Introduction to Automata Theory, Languages and Computation, Third Edition, Pearson, 2008. ISBN-978-81-317-2047-9
3. Kamala Krithivasan, Rama R, Introduction to Formal Languages, Automata Theory and Computation, Pearson, 2009. ISBN-978-81-317-2356-2
4. Christos H. Papadimitriou, Harry R. Lewis, Elements of the Theory of Computation, Second Edition, PHI Learning, 2009. ISBN-978-81-203-2233-2
5. John C. Martin, Introduction to Languages and The Theory of Computation, Third Edition, Tata McGraw-Hill Education, 2007. ISBN-978-00-706-6048-9
6. Michael Sipser, Introduction to the Theory of Computation, Second Edition, Cengage Learning, 2012. ISBN-978-81-315-1750-5

14CS2048 TOTAL QUALITY MANAGEMENT

Credits: 3:0:0

Objective:

- To understand the concepts and principles of total quality management.
- To introduce philosophies and strategies to quality related issues.
- To provide skills in diagnosing and analyzing problems causing variation in manufacturing and service industry processes.
- To create an awareness about the ISO and QS certification process and its need for the industries.

Outcome:

The student will be able to

- develop quality management philosophies and Frameworks.
- develop in-depth knowledge on various tools and techniques of quality Management.
- develop analytical skills for investigating and analyzing quality management issues in the industry and suggest implementable solutions to those.

Introduction to Quality – TQM framework, benefits, awareness and obstacles– Leadership and Strategic Planning - Customer satisfaction – Employee involvement – Continuous process improvement – supplier partnership - Statistical Process Control – Concept of six sigma – New seven management tools - TQM Tools- Benchmarking– Quality Function Deployment – Failure mode and Effect analysis – Total Productive Maintenance - Quality Management Systems – Quality auditing – ISO 14000 series standards .

Reference Books:

1. Dale H.Besterfiled, et al., Total Quality Management, Pearson Education, Third Edition, 2013. ISBN 978-81-317-3227-4.
2. Poornima M.Charantimath, Total Quality Management, Pearson Education, Second edition, 2013. ISBN 978-81-317-3262-5.
3. Subburaj, Total quality management, McGraw-Hill Education (India) Pvt Limited, 2005.
4. James R. Evans and William M. Lindsay, The Management and Control of Quality, Sixth Edition, Thomson, 2005.

14CS2049 UNIX AND LINUX LAB

Co requisite: 14CS2050 Unix Architecture

Credits: 0:0:2

Objective:

- To learn different unix commands
- To write shell script

Outcome:

The student will be able to

- create/develop his own commands

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2050 UNIX ARCHITECTURE

Pre-requisite: 14CS2037 Operating System

Credits: 3:0:0

Objective:

- To learn the internal working of Unix Kernel, its data structures and system calls.
- To describe the algorithms, memory architecture, process management, system calls, interrupts and exceptions, and system start-up.

Outcome:

The student will be able to

- customize the internal algorithms of kernel
- restructure the start-up process of Operating System
- add any new features into the existing operating system

Introduction to the architecture of the UNIX operating system – The buffer cache - advantages and disadvantages - Performance analysis of cache memory subsystem for multi-core architectures - Essential Unix commands – File system layout – INODE - Structure of a regular file, directories- Design and Implementation of distributed file system - System calls for the file subsystem – pipes—Development of any unix command associated with file operation - process states and transitions – Layout of system memory-– Case study of System memory overflow – The context of a process - Manipulation of the process address space - Process Control: Process Creation - signals – Process termination - process scheduling – System calls for time- clock, Swapping – Demand Paging – The I/O subsystem: driver interfaces – Disk drivers – Integration of "hello world" driver module into Linux kernel Terminal driver's stream, Process Tracing- Development of a debugger application to trace user program – System V IPC – Network Communications- – Sockets- Case study - MultiPathTCP in Linux kernel.

Reference Books:

1. Maruice J. Bach, The design of the UNIX operating system, First Edition Reprint, Prentice Hall of India, publication year-2012. ISBN-13 : 978-81-203-0516-8, ISBN-10 : 8120305167
2. Prabhat K. Andleigh, UNIX System Architecture, First Edition Reprint, Prentice Hall, 2005. ISBN: 9780139498435.
3. Kay A. Robbins, Steve Robbins, UNIX Systems Programming, First Edition Reprint, Pearson Education, 2005. ISBN-13: 9788131722084
4. Yashwant Kanetkar**,** Unix Shell Programming, First Edition Reprint, BPB Publications, 2005, ISBN-13 : 978-8170297536

5. Kenneth Rosen, Douglas Host, James Farber, Richard Rosinki, UNIX-The Complete Reference, Second Edition, McGraw- Hill, 2006. ISBN: 9780071706988.
6. Prabhat K. Andleigh, UNIX System Architecture, First Edition Reprint, Prentice Hall, 2005. ISBN: 9780139498435.
7. Ed Dunphy, The UNIX Industry: Evolution, Concepts, Architecture, Applications and Standards, QED Technical Pub, 2007. ISBN: 089435390X, 9780894353901.

14CS2051 INTERNET ROUTING PROTOCOLS LAB

Co-requisite: 14CS2027 Internet Routing Architecture

Credits: 0:0:2

Objective:

- To enable the students to understand the Border Gateway Protocol and experiment BGP.

Outcome:

The student will be able to

- configure, deploy, and troubleshoot the Border Gateway Protocol.
- configure the advanced functions and attributes in BGP.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester

14CS2052 WEB TECHNOLOGY

Credits: 3:0:0

Objective:

- To build web applications using ASP and client side script technologies use with Microsoft's IIS.
- To build XML applications with DTD and style sheets that span multiple domains ranging from finance to vector graphics to genealogy for use with legacy browsers.

Outcome:

The student will be able to

- create richly interactive environments natively within browsers.
- build web application frameworks which facilitate rapid application development.
- integrate web applications easily into other server-side web procedures, such as email and searching.

HTML Essentials - Javascript and HTML Text - Javascript Functions – Objects -Server Side Includes - ASP Request Object - Response Object - Cookies - Application Object - Session Object – Server Object –Microsoft's Universal Data Access Strategy –Errors Collection - XML - Related technologies - Attaching a Style Sheet to an XML Document – Style Languages - CSS Style Sheets - Document Type Definitions - Element Declarations - Entity Declarations- Attribute Declaration

Reference Books:

1. Eric A. Smith, ASP 3 Programming Bible, Wiley-Dreamtech India (P) Ltd, 2005.
2. Robin Nixon, Learning PHP, MySQL and Javascript, O'Reilly Media, Inc., 2009. ISBN: 978-0-596-15713-5.
3. Elliotte Rusty Harold, "XML Bible", IDG Books India (P) Ltd, 2004, Third Edition, ISBN: 0-7645-4986-3.
4. Dave Mercer, ASP 3.0 Beginners Guide, Tata McGraw-Hill Edition, Tenth Reprint, 2008, ISBN:0070586772.
5. Kenneth L. Spencer, Kenneth C. Miller and Lauran Lassesen,Introducing VBScript and ActiveX, Comdex Computer Publication, 1997, ISBN:9780764580109.

14CS2053 WEB TECHNOLOGY LAB

Co-requisite: 14CS2052 Web Technology

Credits: 0:0:2

Objective:

- To enable the students to design and implement dynamic websites with good aesthetic sense.
- To provide the student a good grounding of web application terminologies and scripts.

Outcome:

The student will be able to

- design web sites utilizing multiple tools and techniques.
- utilize entry-level system analysis and design principles to solve business problems.
- have an understanding of Client/Server databases.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2054 C# AND .NET PROGRAMMING

Pre-requisite: 14CS2035 Object Oriented Programming in C++

Credits: 3:1:0

Objective:

- To introduce core and advanced programming constructs in C# and .NET platform.
- To develop windows and web applications along with data access methods.

Outcome:

The student will be able to

- work in various areas in .NET and to understand the concepts in C#
- grow in web development applications using ASP.NET web forms and ADO.NET

.NET Architecture – C# Basics - Objects and Types – Inheritance – Arrays-Operators and Casts - Delegates and Events - Strings and Regular Expressions - Collections-Memory Management and Pointers - Reflection - Errors and Exceptions - Assemblies - Threading and Synchronization- Data Access - Windows Forms - Data Binding - ASP.NET Pages – ASP.NET Development - ASP.NET AJAX.

Reference Books:

1. Christian Nagel, Bill Evjen, Jay Glynn, Morgan Skinner, Karli Watson, Professional C# 2008, Wiley Publishing, Inc., 2008. ISBN: 978-8-126-51627-8.
2. Andrew Troelson, Pro C# 2008 and the .NET 3.5 Platform, Apress, Fourth Edition, 2007.ISBN: 978-81-8128-878-3.
3. Kogent Solutions, C# 2008 Programming: Covers .net 3.5 Black Book, Dreamtech Press, Platinum Edition, 2009. ISBN: 8177228323.
4. Don Gosselin, ASP .NET Programming with C# and SQL Server, Cengage Learning, 2009, ISBN1423903242

14CS2055 C# AND. NET PROGRAMMING LAB

Co-requisite: 14CS2054 C# and .Net Programming

Credit: 0:0:2

Objective:

- To introduce core and advanced programming constructs in C# and .NET platform.
- To develop windows and web applications along with data access methods.

Outcome:

The student will be able to

- work in various areas in .NET
- understand the concepts in C# and implement different concepts of C# in various applications
- grow in web development applications using ASP.NET Web Forms and ADO.NET

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2056 DESIGN PATTERNS

Credits: 3:0:0

Objective:

- To provide an overview of the concepts, processes, and techniques associated with formal design pattern and to learn about the design pattern strategies.
- To develop skills that will enable to construct different types of patterns like creational, structural and behaviour patterns.
- To experience object oriented concepts in different perspective.

Outcome:

The student will be able to

- design a reusable object oriented software that can be adaptable to any type of project needs.
- handle object oriented programming languages like C++ and Java for current design needs.

Introduction to design Pattern – Designing a document Editor – A case Study-Creational patterns - Abstract Factory method - Builder Factory Method-Prototype-Singleton-Discussion of Creational Patterns-Structural patterns - Adapter-Bridge-Composite-Decorator-Facade-Flyweight-Proxy- Discussion of Structural Patterns-Behavioral patterns I - chain of Responsibility-Command-Interpreter-Iterator-Mediator-Memento-Observer - Behavioral patterns II - State-Strategy-Template Method-Visitor- Discussion Of Behavioural Patterns- The Pattern Community-An Invitation-A Parting Thought.

Reference Books:

1. Erich Gamma, Richard Helm, Ralph Johnson, John Vissides, Design Patterns- Elements Reusable Object Oriented Software", Twelfth Edition, illustrated, revised 2011, ISBN 978-81-317-0007-5.
2. Eric Freeman, Elisabeth Robson, Bert Bates, Kathy Sierra. Head First Design Patterns, 2004, O'Reilly Media, ISBN 978-0-596-00712-6.
3. Wolfgang Pree, Design Patterns for Object Oriented Software Development, 1995, Addison - Wesley Publishing, ISBN 0-201-422948.
4. John Vlissides, Pattern Hatching: Design Patterns Applied, 1998, Addison-Wesley Publishing, ISBN 0-201-43293-5.

14CS2057 PROGRAMMING IN J2EE

Pre-requisite: 14CS2040 Programming in Java

Credits: 3:1:0

Objective:

- To develop the enterprise applications with cross platform capabilities.
- To explore the concepts of multi-tier distributed applications.
- To understand the working principles of real time enterprise applications.
- To know about various components of J2EE to develop enterprise applications.

Outcome:

The student will be able to

- get a practical exposure to real time web based projects.
- make innovative ideas to develop enterprise applications.

J2EE AND J2SE - J2EE Multi-Tier Architecture - J2EE best practices – Requirement And Design Analysis of a Software System - JDBC Objects - Java servlets - Java Server pages – Web Application Development using Servlet and JSP - Enterprise Java Bean – Session Bean – Java Persistence API – Entity Beans – Message Driven Bean – Enterprise Application Development using JPA - Java remote method invocation – Java Mail API - Java Interface Definition Language and CORBA - Java Message Service – Security - Java Naming and Directory Interface API – Distributed Application Development with Mailing Facility using SDLC - SOAP - Universal Description, Discovery, and Integration (UDDI)-Electronic Business XML - The Java API for XML Registries (JAXR) - Web Services Description Language (WSDL) – Demonstration of Accessing Web Services using Web Service Bindings.

Reference Books:

1. James Keogh, J2EE - The Complete Reference, McGraw-Hill, Twenty Eighth Reprint 2010. ISBN-10:070529124, ISBN-13:9780070529120.
2. Rima Patel, Gerald Brose, Micah Silverman, Mastering Enterprise JavaBeans 3.0, Wiley-India Edition, 2008. ISBN-10: 0471785415, ISBN-13: 978-0471785415.
3. Bryan Basham, Kathy Sierra, Bert Bates, Head First Servlets and JSP, O'Reilly Media, 2008. ISBN: 0596516681, ISBN-13: 9780596516680.
4. Esmond Pitt, Kathleen McNiff, java.rmi: The Remote Method Invocation Guide, Addison-Wesley Professional, 2001. ISBN-10: 0201700433, ISBN-13: 978-0201700435.
5. Kathy Sierra, Bert Bates, Head First EJB, O'Reilly Media, 2005. ISBN-10: 0596005717, ISBN-13:978-0596005719.

14CS2058 PROGRAMMING IN J2EE LAB

Co –requisite: 14CS2057 Programming in J2EE

Credits: 0:0:2

Objective:

- To provide real time project development exposure.
- To give practical applicability of J2EE concepts
- To understand the implementation details of real time web applications

Outcome:

The student will be able to

- get detailed exposure to enterprise application development.
- know about development of web based real time applications.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2059 PROGRAMMING IN J2ME LAB

Co-requisite: 14CS2062 Programming in J2ME

Credits: 0:0:2

Objective:

- To explore the concepts of developing Java applications for small computing devices
- To give exposure to develop mobile application.

Outcome:

The student will be able to

- get a detailed exposure to create mobile application.
- get knowledge to design interface for mobile application.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2060 VISUAL PROGRAMMING

Credits: 3:0:0

Objective:

- To introduce the concepts of visual programming.
- To introduce GUI programming using Microsoft foundation classes.

Outcome:

The student will be able to

- develop Windows application using the Microsoft Foundation Classes (MFC).
- develop C++/CLI Windows applications using Windows Forms.

The .NET Framework – Learning Windows Programming – Integrated Development Environment- The Structure of a Windows Program – The Microsoft Foundation Classes- The Document/View Concept in MFC – Working with Menus and Toolbars- The Drawing Mechanism in Visual C++ –Programming the Mouse-Using the Template Class – Creating the Sketch Document – Improving the View – Deleting and Moving Shapes – Implementing a Context Menu – Working with Dialogs and Controls-Understanding Serialization – Printing a document-Implementing DLLs-Connecting to Data Sources-Database Transaction based applications-SQL-Sorting and Updating Record set.

Reference Books:

1. Ivor Horton, Beginning Visual C++ 2012, Wiley Dreamtech India Pvt, 2008, ISBN:978-1-118-36808-4
2. James Allert, Programming with Visual C++: Concepts and Projects, Cengage Learning, 2008, ISBN 142390186X
3. Steve Holzner, Professional Visual C++ 6 Programming, Wiley Dreamtech India Pvt. 2003
4. David J. Kruglinski, George Shepherd and Scot Wingo, Programming Microsoft Visual C++, Fifth Edition, Microsoft Press 2003.

14CS2061 VISUAL PROGRAMMING LAB

Credit: 0:0:2

Objective:

- To introduce the basic window program creation.
- To develop GUI programming skills using sketcher.
- To enable the students to serialize and print a document.
- To create database applications in Windows Programming.

Outcome:

The student will be able to:

- develop menus, toolbars and dialog controls in Window Programs.
- graphically enhance any given view and print the document.
- create database applications in VC++.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2062 PROGRAMMING IN J2ME

Pre-requisite: 14CS2040 Programming in Java

Credits: 3:0:0

Objective:

- To know the basic concepts of small computing devices.
- To explore the concepts of developing java applications for small computing devices
- To understand the various components of J2ME platform.
- To know about the architecture of J2ME.

Outcome:

The Student will be able to

- understand the working principles of application in small computing devices.
- develop applications for small computing devices like PDA and Mobiles.
- come up with innovative ideas for developing mobile applications.

J2ME Overview – Small Computing Technology – J2ME Architecture and Development Environment-J2ME User Interface – High Level Display – Low Level Display-Record Management System – J2ME Database Concepts - J2ME Personal Information Manger Profile-
JDBC Objects – JDBC and Embedded SQL-Generic Connection Framework – Web Services.

Reference Books

1. James Koegh, J2ME – The Complete Reference, Tata McGraw-Hill, Seventeenth Reprint 2008, ISBN-13: 9780070534155, ISBN-10:0070534152.
2. Vikram Goyal, Pro Java ME MMAPI: Mobile Media API for Java Micro Edition, Apress 2006,ISBN-10: 1590596390, ISBN-13: 978-1590596395
3. Vartan Piroumian, Wireless J2ME Platform Programming, The Sun Microsystems Press, Java Series, 2002, ISBN-10: 0130449148.
4. Sing Li, Jonathan Knudsen, Beginning J2ME from Novice to Professional, Third Edition Springer (India) Private Limited publications, Fifth reprint 2007, ISBN 978-81-8128-2927.
5. Kim Topley, J2ME – In a Nutshell, O'Reilly publications, 2002. ISBN: 81-7366-343-2.
6. John W. Muchow, Core J2ME Technology, First Edition, Prentice Hall PTR. ISBN-10: 0130669113.

14CS2063 MOBILE APPLICATION DEVELOPMENT IN ANDROID

Prerequisite: 14CS2040 Programming in Java

Credits : 3:1:0

Objective:

- To learn the platform, tools and technology and process for developing mobile applications using Google Android.
- To get exposure about file system, multimedia, database and connectivity in the Android operating system.

Outcome:

Students will be able to

- Have a clear understanding of the creation and use of simple user interfaces.
- Use tools to create applications for a mobile platform.
- Create simple graphics for mobile devices.
- Appropriately use different types of networking options for mobile devices.

Introduction – Android Architecture - Android SDK Features – Development Framework – Basics of Android Application – Android Development Tools – Study of Various Mobile Phone Emulators - Creating Applications and Activities – Creating User Interfaces – Intents, Broadcast Receivers, Adapters and Internet – Development of Mobile Gadget using Activity and Intent - Files and Saving Activity State – Databases and Content Providers – Maps, Geocoding and Location-Based Services – Mobile Application Development using SQLite and Google API - Multimedia in Android – Gaming Application Development using Multimedia - Telephony and SMS – Network Connectivity – Mobile Application Development using SQLite, GPS, Connectivity and Multimedia.

Reference Books:

1. Reto Meier, Professional Android 4 Application Development, Third edition, Wrox, 2012. ISBN 978-1118102275.
2. Zigurd Mednieks, Laird Dornin, G. Blake Meike, Masumi Nakamura, Programming Android, Second Edition, O'Reilly Media , 2012. ISBN 978-1449316648
3. Donn Felker, Android Application Development For Dummies, For Dummies, 2010. ISBN 978-0470770184.
4. Wallace Jackson, Android Apps for Absolute Beginners, Apress, 2011. ISBN 978-1430234463.

14CS2064 MOBILE COMPUTING

Pre-requisite: 14CS2007 Computer Networks

Credits: 3:0:0

Objective:

- To introduce the basic concepts and principles in mobile computing.
- To provide exposure to the major techniques involved and networks and systems issues for the design and implementation of mobile computing systems and applications.

Outcome:

The students will be able to

- understand the concept of GSM,GPRS,WAP,CDMA, 3G etc
- have a good understanding of how the underlying wireless and mobile communication networks work and their technical features
- identify the important issues of developing mobile computing systems and applications

Introduction, mobile computing architecture, mobile computing through telephony, emerging technologies, global system for mobile communication(GSM), short message service(SMS), general packet radio service(GPRS), wireless application protocol(WAP), CDMA and 3G, wireless LAN, intelligent networks and internetworking, client programming, program for the palm OS, voice over IP and convergence, multimedia, security issues in mobile computing.

Reference Books:

1. Asoke K Talukder, Hasan Ahmed, Roopa R Yavagal, Mobile Computing Technology, Applications and Service Creation, 2nd edition, Tata McGraw Hill, 2010. ISBN 978-00-701-4457-6
2. Uwe Hansmann, Lothar Merk, Martin S Nicklous, Thomas Stober, Principles of Mobile Computing, 2nd edition, Wiley, 2006. ISBN 978-81-812-8073-2
3. Prasant Kumar Pattnaik, Rajib Mall, Fundamentals of Mobile Computing, PHI Learning, 2012. ISBN 978-81-203-4632-1
4. Raj Kamal, Mobile Computing, 2nd edition, Oxford University Press, 2011, ISBN 978-01-980-6891-4
5. Bfar, Mobile Computing principles, 1st edition, Cambridge University Press, 2008, 978-05-216-9623-4

14CS2065 STORAGE AREA NETWORK

Prerequisite: 14CS2007 Computer Networks

Credits: 3:0:0

Objective:

- To provide students a broad and in-depth knowledge of storage, storage networking concepts, applications and technologies.
- To learn about storage fundamentals including storage attachment architectures and storage networking issues.

Outcome:

Student will be able to

- understand the storage fundamentals
- identify the components and uses of a Storage Area Networks (SAN)
- classify SAN applications
- categorize storage networking issues

Introduction – Benefits - Data Center Evolution - Killer Apps for SANs - Storage Networking Architecture - The Storage in Storage Networking - The Network in Storage Networking - Basic Software for Storage Networking - Advanced Software for Storage Networking - Enterprise Backup Software for Storage Area Networks - Adopting Storage Networking - Managing SANs

Reference Books:

1. Storage Area Network Essentials: A Complete Guide To Understanding And Implementing Sans, Paul Massiglia Richard Barker, Wiley India Pvt Ltd, 2011
2. Storage networks: the complete reference 1st Edition, Robert spalding, Tata McGraw-Hill Education, Sixth reprint 2008.
3. Information Storage and Management: Storing, Managing And Protecting Digital Information: Storing, Managing and Protecting Digital Information, Emc, Wiley India Pvt Ltd, 2011.
4. Storage Networks Explained : Basics and Application of Fibre Channel SAN, NAS iSCSI and InfiniBand, Ulf Troppen Rainer Erkens Wolfgang Muller, Wiley India Pvt Ltd, 2012

14CS2066 TCP/IP

Pre-requisite: 14CS2007 Computer Networks

Credits: 3:0:0

Objective:

- To provide a solid foundation for understanding the communication process of the Internet
- Provide exposure to fundamental concepts of computer networking in the context of the TCP/IP model and protocols.

Outcome:

The students will be able to

- understand the functionality of reference model thoroughly.
- have a good understanding of various protocols in different layers and how they are working.
- get an exposure to various next generation protocols in internetworking.

The OSI model and TCP/IP protocol suite, Underlying Technologies, Introduction to network layer, IPv4 Addresses, Delivery and forwarding of IP Packets, Internet Protocol version 4, Address Resolution Protocol, Internet control message protocol version 4, Mobile IP, Unicast routing protocols, Multicasting and multicast routing Protocols, Transport layer, Application layer, IPv6 Addressing, IPv6 Protocol, ICMPv6

Reference books:

1. Behrouz A. Forouzan, TCP/IP Protocol Suite, 4th edition, McGraw Hill, 2013. ISBN 978-0-07-070652-1
2. Douglas E. Comer, Internetworking with TCP/IP: principles, protocols and architecture (Volume1), 6th Edition, PHI Learning, 2013, ISBN 978-8-12-034867-7
3. Douglas E. Comer, David L. Stevens, Internetworking with TCP/IP, design, implementation and internals (Volume 2), 3rd Edition, PHI Learning, 2009, ISBN 978-8-12-032285-1
4. Ed Tittel, Laura Chappell, TCP/IP, 1st Edition, Cengage Learning, 2008, ISBN 978-8-13-150596-0
5. Dr. Sidnie Feit, TCP/IP, architecture, protocols and implementation with IPv6 and IP Security, Tata McGraw-Hill, 2008, ISBN 978-0-07-026496-0

14CS2067 WIRELESS AND VOIP SECURITY

Pre-requisite: 14CS2008 Cryptography and Network Security

Credits: 3:0:0

Objective:

- To provide exposure to various threats in wireless networks and security solutions.
- To understand the technologies and protocols that support security in wireless networks.
- To understand VoIP and its security.

Outcome:

The students will be able to

- gain an in-depth understanding of the development of Wireless Security and its related attacks
- learn about the technologies and protocols that make up real secured wireless Network.
- gain an in-depth understanding about VoIP security.

Introduction, Security Principles, Wi-Fi Vulnerabilities, Different Types of Attack, Wireless Information warfare, IEEE 802.11 Protocol Primer, IEEE 802.11, WEP Working, WPA, RSN and IEEE 802.11i, Access Control: IEEE 802.1X, EAP and RADIUS, Upper- Layer Authentication, WPA and RSN Key Hierarchy, TKIP, Introduction to VoIP - Sources of Vulnerability, VoIP Threat Taxonomy, Security Profiles in VoIP Protocols, VoIP Network Elements, Analysis and Simulation of Current Threats.

Reference Books:

1. Jon Edney, William A.Arbaugh, Real 802.11 Security Wi-Fi Protected Access and 802.11i, Pearson Education, 2004. ISBN: 81-297-0312-2.
2. Randall K.Nichols, Panos C. Lekkas, Wireless Security: Models, Threats and Solutions,Tata McGraw Hill, 2006. ISBN: 0-07-061884-4.
3. Pallapa Venkataram, Sathish Babu, Wireless and Mobile Network Security, Tata McGraw-Hill, 2010, ISBN: 9780070700246
4. Patrick Park, Voice over IP Security, 1st edition, Cisco Press, 2011, ISBN: 978-81-317-3488-9
5. Thomas Porter, Michael Gough, How to Cheat at VoIP Security, 1st edition, Syngress Publishing, 2007, ISBN 978-1-59749-16

14CS2068 ESSENTIALS OF PROGRAMMING

Credits: 3:0:0

Objectives:

- To learn basics of computing
- To enhance the problem solving skills
- To empower the students with an idea of developing the programming logic
- To learn about the basics of C programming

Outcome:

Students will be able to

- understand the fundamentals of Computer models
- understand the basics of C programming language
- understand the emphasis of conceptual design and implementation of programming languages.

Fundamentals of Computers, Number System, Computer Software, Hardware, Information Technology and Internet. Introduction to Programming, Problem solving Techniques, Variables and Constants, Data Types, Operators and Priority, Input and Output in C. Control statements: Branching, Selection, Looping statements, break, continue, goto statement. Functions, Arrays, Functions with Pointers, Pointer to Function, Strings, Storage classes in C. User-defined Data Types, Structure, Array of Structures, Union, Pointers and File System

Reference Books:

1. Ashok N. Kamthane. "Computer Programming", Second Edition, Pearson Publications, New Delhi, 2012, ISBN: 978-81-317-6494-7.
2. Byron S. Gottfried, "Programming with C", Indian Adapted Edition, Tata McGraw Hill, 2006, ISBN: 0-07-059369-8.
3. Herbert Schildt, "The Complete Reference C", Fourth Edition, McGraw-Hill Publications, 2007, ISBN: 978-0072121247.
4. Yashwant kanetkar, "Let us C", 10th Edition, BPB Publications,2010, ISBN: 978-81-8333-163-0.
5. Kashi Nath Dey, Samir Bandyopadhyay, "C Programming Essentials", 2010, Dorling Kindersley (India) Pvt. Ltd., ISBN: 978-81-317-2889-5.
6. Anita Goel, Ajay Mittal, "Computer Fundamentals and Programming in C", 2013, Dorling Kindersley (India) Pvt. Ltd., ISBN: 978-93-325-1934-3.
7. E.Balagurusamy, "Programming in ANSI C", Sixth Edition, Tata McGraw Hill, 2012, ISBN: 978-1-25-900461-2.

14CS2069 ESSENTIALS OF PROGRAMMING LAB

Co-requisite: 14CS2068 Essentials of Programming

Credits: 0:0:2

Objectives:

- To learn basic C program
- To learn looping control structures in C
- To learn Operators and Functions in C
- To learn about the Arrays and Structures in C
- To learn about the pointers and file system in C

Outcome:

Students will be able to

- implement the concepts of programming in C
- implement the structured data types programs in C
- design and implement a given scenario.
- implement the pointers and file system in C

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS2070 MULTIMEDIA LAB

Credits: 0:0:2

Objective:

- To facilitate an understanding of how to create and design user-centered multimedia.
- To provide hands-on experience in multimedia production, including digitization of images, sounds, animation and video.

Outcome:

The student will be able to

- demonstrate proficiency using multimedia software.
- illustrate concepts of design.
- design, develop and execute a short multimedia project.
- create experimentation, analytic reflection, self-critique and problem solving on multimedia technologies.
- exhibit professional behavior and work ethics.

The faculty conducting the laboratory will prepare a list of 12 Experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3001 ACCESS AND IDENTITY MANAGEMENT

Credit 3:0:0

Objective:

- To understand Access Manager proxy administration and identity provider administration
- To know how to troubleshoot identity server and access gateway
- To know about single sign on, identity sharing, federation, SSL VPN, backup and fault tolerance.

Outcome:

The student will be able to

- develop advanced policies

- implement advanced drivers
- create advanced entitlements
- configure custom workflows

Introduction to Access manager –Identity server installation, configuration – Access Gateway installation – Administration console – logging for troubleshooting and compliance – webserver acceleration – HTML rewriting – Certificate management – Introduction to identity manager – Architecture – IDM drivers (understanding and customization) – Workflow. Manage workflow, policies and filters – Installation and configuration of IDM.

Reference Books:

1. NetIQ Access manager –lecture, Novell Inc., USA
2. MessaoudBenantar, Access Control Systems: Security, Identity Management and Trust Models, Springer, 2006, ISBN-13: 978-0387004457
3. Raj Sharman, Sanjukta das Smith, Manish Gupta, Digital Identity and Access Management: Technologies and Frameworks, Business Science Reference, 2012, ISBN-13: 978-1613504987.
4. Elisa Bertino, Kenji Takahashi, Identity Management: Concepts, Technologies, and Systems, Artech House, 2011, ISBN: 978-1608070409.

14CS3002 MULTIMEDIA DESIGN STORAGE AND ANALYSIS

Credits: 3:0:0

Objective:

- To provide a more dynamic fully integrated multimedia working systems by combining audio and video with text, image, graphics and animation.
- To present step-by-step approach to multimedia system design.
- To introduce multimedia standards, compression technologies as well as various storage technologies.
- To introduce the fundamental concepts of content based information retrieval of images, Audio and video.

Outcome:

Students will be

- equipped with the knowledge of integrated multimedia working systems.
- able to understand the multimedia standards, and the concepts of content based information retrieval of multimedia data.

Multimedia Compression- Multimedia Data Interface Standards-Multimedia Databases- Compression schemes-Video, Image and audio compression-Storage and Retrieval- Memory Systems-Multimedia Board Solutions-Distributed Object Models- Application Design- Organizing Databases- Design Issues- Design Issues- Hypermedia-Mobile Message- Linking and Embedding- Integrated Document Management- Video analysis and summarization-Content-based retrieval for digital audio and music- MPEG-7 standard- Object repositories for digital libraries-Information discovery on WWW-Cooperative Multimedia Information systems.

Reference Books:

1. Prabhat K. Andleigh and Kiran Thakrar , Multimedia Systems Design, Prentice Hall, 2008, ISBN -978- 81-203-2177-9.
2. David Dagan Feng, Wan-Chi Siu, Hong-Jiang Zhang, Multimedia Information Retrieval and Management Technological Fundamentals and Applications, Springer, 2003. ISBN: 978-3-540-00244-4.
3. Nigel Chapman and Jenny Chapman, Digital Multimedia , John Wiley and Sons Private Limited, 2001, ISBN: 0471983861.
4. William I. Grosky, Ramesh Jain, Rajiv Mehrotra, The Handbook of Multimedia Information Management, Prentice Hall, 1997. ISBN: 0132073250, 9780132073257
5. Ze-Nian Li. Mark S. Drew, Fundamentals of Multimedia, First Edition 2004, ISBN: 81-297-0-438-2.
6. Tay Vaughan, Multimedia Making it work, Sixth Edition, Tata McGraw-Hill, 2003. ISBN- 13: 978-0072230000.
7. John F. Koegel Buford, Multimedia Systems, Third Edition, 2000, ISBN: 8177588273.

14CS3003 ADVANCED COMPUTER ARCHITECTURE

Credits: 3:0:0

Objective:

- To study on computer architecture concepts
- To study on different architectures and design principles
- To study on pipelining, parallel computer models and memory concepts

Outcome:

The student will be able to

- learn computer architecture concepts, design principles

Introduction to parallel computer models - fundamentals of computer design - instruction set principles-pipelining concepts-instruction level parallelism and its dynamic exploitation-parallel computer models-advanced processors - memory hierarchy.

Reference Books:

1. John L. Hennessy and David Patterson, Computer Architecture, A Quantitative Approach, Fourth Edition, Elsevier, 2006. ISBN-13: 9780123704900.
2. Kai Hwang, Advanced Computer Architecture, Parallelism, Scalability, Programmability, McGraw-Hill, ISBN: 0070316228, Eighteenth Reprint-2008
3. Barry Wilkinson and Michael Allen, Parallel Programming: Techniques and Applications Using Networked Workstations and Parallel Computers, 2nd Edition, Prentice Hall, 2005. ISBN: 0-13-140563-2.
4. K. Hwang and F. A. Briggs, Computer Architecture and Parallel Processing, McGraw -Hill, New York, 2012, ISBN: 9781259029141,
5. H.S.Stone, High Performance Computer Architecture, Addison Wesley, Reading Mass, 2009, Reprint Edition ISBN: 9780201168020.
6. W. Stallings, Computer Organization and Architecture, Ninth Edition, 2012, ISBN 9780132936330.

14CS3004 ADVANCED DATABASE LAB

Co-requisite: 14CS3005 Advanced Database Systems

Credit: 0:0:2

Objective:

- To familiarize with PL/SQL for storing, maintaining and querying large databases effectively.
- To familiarize with advanced techniques in handling concurrent transactions.

Outcome:

The student will be able to

- gain experience in installing commercial development suite
- query database using simple and advanced query concepts
- handle concurrent transactions
- design and implement database applications

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3005 ADVANCED DATABASE SYSTEMS

Pre-requisite: 14CS2011 Database Systems

Credits: 3:0:0

Objective:

- To provide extensive knowledge on the advanced topics in database technologies.
- To provide an application-oriented and system-oriented approach towards database design.

Outcome:

The student will be able to

- understand normalization and indexes and will be able to tune databases efficiently
- understand the concepts of transaction management, concurrency control and other related concepts
- be able to apply locks and isolation levels to the concurrent transactions
- get a exposure on latest trends of database technologies

Overview of query evaluation and transaction management - system catalog - query optimization- transaction management - lock-based concurrency control - performance of locking-concurrency control and recovery – 2PL, serializability and recoverability - lock management - specialized locking techniques - introduction to ARIES - recovery from system crash-database tuning and security and authorization - overview of database tuning - tuning conceptual schema - tuning queries and views - access control - discretionary and mandatory access control-introduction to parallel and distributed databases - architecture - query evaluation - data replication and updation – transaction management - concurrency control – recovery-emerging technologies – XML querying– efficient evaluation of XML queries - spatial data management - spatial indexes - mobile databases - multimedia databases - genome data management.

Reference Books:

1. Elmasri and Navathae, Fundamentals of Database Systems, Sixth Edition, Pearson Education /Addison Wesley, 2010. ISBN 0136086209
2. Abraham S., Henry F.Korth and Sudarshan, Database System Concepts, Fifth Edition, McGraw-Hill Publication, 2006. ISBN: 007-124476-X
3. Thomas C. and Carolyn B., Database Systems – A Practical Approach to Design, implementation, and Management, Third Edition, Pearson Education, 2007. ISBN 81-7808-861
4. Li Yan, Zongmin Ma, Advanced Database Query Systems: Techniques, Applications and Technologies, Idea Group Inc (IGI), 2011,ISBN-160960475X
5. Raghu R. and Johannes G., Database Management Systems, Third Edition, Tata McGraw Hill, 2003. ISBN 0-07-115110-9 (ISE)

14CS3006 ADVANCED OPERATING SYSTEMS

Credits: 3:0:0

Objective:

- To provide comprehensive and up-to-date coverage of the major developments in distributed Operating System, Multi-processor Operating System and Database Operating System
- To cover important distributed operating system concepts like Process Synchronization, Concurrency, Event ordering, Mutual Exclusion, Deadlock, Agreement Protocol, Security, Recovery and fault tolerance.

Outcome:

The student will be able to

- understand the architecture of distributed operating system
- understand the issues in designing a distributed operating system

Process synchronization - architectures of distributed systems, theoretical foundations - distributed mutual exclusion - distributed deadlock detection, agreement protocols-distributed file systems - distributed shared memory - distributed scheduling-failure recovery, fault tolerance-resource security and protection - multiprocessor system architectures-introduction to database operating systems - concurrency control- theoretical aspects - concurrency control algorithms.

Reference Books:

1. Ajay D. Kshemkalyani, Mukesh Singhal, Distributed Computing: Principles, Algorithms, and Systems, 2011, Cambridge University Press; Reissue edition. ISBN-10: 0521189845
2. George Coulouris, Jean Dollimore, Tim Kindberg, Distributed Systems Concepts and Design, fifth Edition 2011, ISBN-10: 0132143011.
3. Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Operating System Principles, JohnWiley and Sons, Seventh Edition, 2006. ISBN: 9812-53-176-9.
4. Mary Gorman, Todd Stubbs, Introduction to Operating Systems: Advanced Course, CourseTechnology, 2003. ISBN: 9780619055301.
5. Yair Wiseman, Song Jiang, Advanced Operating Systems and Kernel Applications: Techniques and Technologies, IGI Global Snippet, 2010, ISBN-1605668516

14CS3007 ADVANCED OPERATING SYSTEMS LAB

Co-requisite: 14CS3006 Advanced Operating System

Credits: 0:0:2

Objective:

- To provide comprehensive and up-to-date coverage of the major developments in distributed operating system, Multi-processor operating system and database operating system
- To cover important distributed operating system concepts like Process Synchronization, Concurrency, event ordering, mutual exclusion, deadlock, agreement protocol, security, recovery and fault tolerance.

Outcome:

The student will be able to

- simulate and test various operating system algorithms
- write Shell programs and use various unix system calls and commands

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3008 ANALYSIS, ARCHITECTURE AND DESIGN OF NETWORKS

Pre-requisites: 14CS2007 Computer Networks

Credits: 3:0:0

Objective:

- To identify and apply the services and performance levels that a network must satisfy
- To understand the parameters of network analysis such as network service characteristics, performance Characteristics, network requirements analysis, and network flow analysis.

Outcome:

The student will be able to

- develop a comprehensive understanding of the Analysis, Architecture and Design methodologies.
- apply the gained knowledge in Network or Solution projects.

- understand various Simulation/Emulation Tools in Network Analysis.

Introduction- Overview of Analysis, Architecture and Design Processes – A Systems - Methodology - Requirements Analysis- Concepts - Requirements Analysis Process -Flow Analysis- – Identifying and Developing Flows – Data Sources and Sinks – Flow Models - Network Architecture - Addressing - Routing Architecture - Performance Architecture - Security - Privacy Architecture - Network Design - Management- Security

Reference Books:

1. James D, McCabe, Network Analysis, Architecture and Design, Third Edition, Elsevier, 2008. ISBN: 978-81-312-1259-2.
2. Darren L, Spohn, Tina L. Brown, Scott Garu, Data Network Design, Third Edition, Tata McGraw Hill, 2008 ISBN 978-0-07-0530416
3. James D, McCabe, Network Analysis, Architecture and Design, Second Edition, Elsevier, 2007. ISBN: 1-55860-887-7.
4. Tony Kenyon, High-performance Data Network Design: Design Techniques and Tools, Digital Press, 2002 ISBN 1-55558-207-9
5. Andrew S. Tanenbaum, David J. Wetherall Computer Networks, Fourth Edition, Prentice Hall, Upper Saddle River, New Jersey, 2011. ISBN: 0132553179

14CS3009 APPLIED SECURITY LAB

Co-requisite: 14CS3001 Access and Identity Management

Credit 0:0:2

Objective:

- To experiment access manager proxy administration and identity provider administration
- To experience on how to troubleshoot identity server and access gateway
- To experiment single sign on, identity sharing, federation, SSL VPN, backup and fault tolerance.

Outcome:

The student will be able to

- install identity server and gateway.
- configure security sources.
- set up basic security.
- add user classes, users, and sign-on.
- maintain security and automate administrative tasks.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3010 CLOUD COMPUTING LAB

Co-requisites: 14CS3011 Cloud Computing Services

Credit 0:0:2

Objective:

- To install and configure Cloud environment
- To provide and work with workload instances.

Outcome:

The student will be able to

- install and configure cloud environment
- create and configure a project
- create a security group for web servers
- get a provision a WordPress workload in the cloud

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3011 CLOUD COMPUTING SERVICES

Credit 3:0:0

Objective:

- To introduce the basic concepts of Cloud Computing.
- To introduce new technologies in Cloud Computing.

Outcome:

The student will be able to

- understand Cloud computing and able to setup their own Cloud environment.

Introduction to CLOUD – Cloud Computing Models- Open source cloud computing – Open Stack Cloud – Crowbar - Open stack Core Components – Nova ,Swift,Glance,Dashboard and Keystone – Open Stack Cloud Structure – Admin Node- Control Node-Compute node- Network configuration - Install and configure cloud environment: Preparing the admin host - Install Admin Server using Crowbar - Adding nodes- Cloud administration – Managing users and Projects - Adding Virtual images to cloud – Starting and stopping Virtual machine instances in cloud

Reference Books:

1. SUSE Cloud, Novell Inc., USA
2. John W. Rittinghouse, James F. Ransome, Cloud Computing - Implementation, Management and Security, CRC Press, 2010.
3. Tom White, Hadoop the Definite Guide, O'REILLY, 2009.
4. Judith Hurich, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley Publication Inc., 2010.
5. George Reese, Cloud Application Architectures, O'REILLY, 2009.
6. Tim Mather, SubraKumarasamy, ShahedLatif, Cloud Security and Privacy, O'REILLY, 2009.
7. Introduction to Cloud Computing Architecture, White paper, SUN, Microsystems, 1st edition, June 2009.

14CS3012 USER INTERFACE DESIGN

Credits: 3:0:0

Objective:

- To provide an introduction to the human computer interface.
- To address the interface and screen design from the user's perspective.
- To study and understand the testing methods.

Outcome:

Student will able to

- understand reasoning behind the guidelines and use of the design methods.
- understand interesting possibilities for supporting users in the performance of their tasks and design user interfaces for business web applications.

The Importance of the User Interface -Characteristics of graphical and web user interface- The User interface design process - Important Human Characteristics in Design - Human considerations in the design- Understand the

Business Function - Understand the principles of good Screen Design - Develop System Menus and Navigation Schemes - Select the Proper Kinds of Windows - Interaction Devices- Collaboration and Social Media Participation- Design issues- Quality of Service-Balancing Function and Fashion - Choosing Colors and Windows Layouts- Organize and Layout Windows and Pages- Test and Retest- User Documentation and Online Help- Information Visualization.

Reference Books:

1. Wilbert. O. Galitz, The Essential Guide to User Interface Design: An Introduction to GUI Design Principles and Techniques, John Wiley and Sons, 2007. ISBN 81-265-0280-0.
2. Ben Shneiderman, Maxine Cohen, Designing the user interface-Strategies for Effective Human-Computer Interaction, Fifth Edition, Pearson Education, 2008. ISBN:13:780321537355
3. Soren Lauesen, User Interface Design: A Software Engineering Perspective, Pearson / Addison-Wesley, 2005, ISBN 0321181433
4. Alan J. Dix, Janet E. Finlay, Gregory D. Abowd, Russell Beale, Janet E. Finley., Human-Computer Interaction, Third Edition, Prentice Hall, 2004. ISBN 978-0130461093

14CS3013 MPLS AND VPN

Pre-requisite: 14CS2007 Computer Networks

Credits: 3:0:0

Objective:

- To expose the students to understand, design, and deploy Multiprotocol Label Switching (MPLS)-based Virtual Private Networks (VPNs).
- To learn MPLS theory and configuration, network design issues, and MPLS-based VPNs.
- To get in-depth analysis of MPLS architecture

Outcome:

The students will be able to

- understand how MPLS scales to support tens of thousands of VPNs
- design and deployment of real-world MPLS/VPN networks
- configure MPLS on Cisco devices
- build various VPN topologies

MPLS Architecture Overview, Frame-mode MPLS Operation, Cell-mode MPLS Operation, Running Frame-mode MPLS Across Switched WAN Media, Advanced MPLS Topics, MPLS Migration and Configuration Example, MPLS Troubleshooting, VPN Implementation Options, MPLS/VPN Architecture Overview, MPLS/VPN Architecture Operation, Provider Edge (PE) to Customer Edge (CE) Connectivity

Reference Books:

1. Uyless Black, "MPLS and Label Switching Networks", Prentice Hall, 2002, 2nd edition, ISBN: 978-0130158239
2. Sean Harnedy, "The MPLS Primer: An Introduction to Multiprotocol Label Switching", 2001, Prentice Hall, ISBN: 978-0130329806
3. Ivan Pepelnjak, Jim Guichard, "MPLS and VPN Architectures CCIP Edition", 2002, Cisco Press, ISBN: 1-58705-081-1
4. Ruixi Yuan, W. Timothy Strayer, "Virtual Private Networks: Technologies and Solutions", 2001, Addison-Wesley Professional, ISBN: 978-0201702095
5. Dave Kosiur, "Building and Managing Virtual Private Networks"Wiley; ISBN: 978-0471295266
6. Dennis Fowler, "Virtual Private Networks: Making the Right Connection", Morgan Kaufmann, 1999, ISBN: 978-1558605756

14CS3014 COMPUTER GRAPHICS AND APPLICATIONS

Credits: 3:0:0

Objectives:

- To understand the foundations of computer graphics: hardware systems, math basis, light and colour.
- To implement key components of the rendering pipeline, especially visibility, viewing, and shading.
- To provide knowledge about modelling of characters, techniques about 3D computer animation and rendering.

Outcome:

The student will be able to

- get knowledge of fundamental hardware and software concepts of interactive computer graphics such as raster displays, color systems, processor architectures and displays.
- understand of the mathematics of geometric transformations as applied to two and three-dimensional graphics.
- understand graphics application programming through projects using standard graphics libraries.

Overview of graphics systems-video display devices- line drawing algorithms-ellipse generating algorithms-attributes of graphics primitives - geometric transformations- basic two dimensional geometric transformations- two dimensional composite transformations- geometric transformations in three dimensional space- the two dimensional viewing - preproduction and modeling basics – preproduction- storyboarding-production scheduling- modeling basics- polygonal modeling- splines and patches- transformations- basic deformations-case study: character modeling using blender -rendering basics- introduction-shading and rendering algorithms-surface texture mapping-final rendering - advanced rendering- introduction - atmospheric effects- advanced texturing- non photorealistic rendering- more rendering algorithms

Reference Books:

1. Donald Hearn, M.Pauline Baker, Computer Graphics with OpenGL, Pearson Education, Third Edition, 2009, ISBN: 978-81-317-2738-6.
2. Michael O'Rourke, Principles of Three-Dimensional Computer Animation, Third Edition, W.W.Norton and Company Ltd., 2003. ISBN: 0-393-73083-2.
3. F.S.Hill JR, Computer graphics using Open GL, Second Edition, Prentice Hall, 2007, ISBN: 0131362623.
4. John Vince, Essential Computer Animation, Springer-Verlag, 2000, ISBN: 1-85233-141-0.
5. Marcia Kuperberg, A Guide to Computer Animation, Focal Press, 2012, ISBN: 1136134859.

14CS3015 DATA MINING LAB

Co –requisite: 14CS3074 Advanced Data Mining

Credit: 0:0:2

Objective:

- To understand the concept of data mining algorithms for solving practical problems
- To provide hands-on experience in using data mining tools
- To get an insight into different aspects of data mining techniques like data preprocessing, data selection, classification, clustering and association
- To understand the statistical techniques to analyze the results

Outcome:

The students will be able to

- select the appropriate data mining algorithm to solve any practical problem
- preprocess the data and efficiently execute the algorithm to solve the problem
- analyze and compare the results of different data mining algorithms

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3016 APPLIED MEDICAL IMAGE PROCESSING

Credits: 3:0:0

Objective:

- To provide basic introduction to medical field, emphasizing special requirements for processing medical imaging data
- To provide basics of medical image sources like CT, MRI, Ultrasound imaging techniques
- To address the most frequently used visualization techniques in medical imaging, including image segmentation and tomographic reconstruction

Outcome:

The student will be able to

- understand the special requirements for processing medical image data
- understand the basics of medical image sources like CT, MRI, Ultrasound imaging techniques
- gain knowledge on the frequently used visualization techniques in medical imaging, including image segmentation and tomographic reconstruction

Basics of medical image sources-Image representation-Operation in intensity space-Filtering and transformation-Segmentation-Spatial transforms-Registration-Rendering and Surface models-CT reconstruction-Image compression

Reference books:

1. Wolfgang Birkfellner, Applied Medical Image Processing: A Basic Course, CRC Press, 2011, ISBN: 1439824452, 9781439824450
2. Isaac Bankman, Handbook of Medical Image Processing and Analysis, Second edition, Academic Press, 2008, ISBN: 008055914X, 9780080559148
3. Geoff Dougherty, Digital Image Processing for Medical Applications, Cambridge University Press, 2009, ISBN: 0521860857, 9780521860857
4. Geoff Dougherty , Medical Image Processing: Techniques and Applications, Springer, 2011, ISBN: 1441997792, 9781441997791
5. Paul Suetens, Fundamentals of Medical Imaging, Cambridge University Press, 2009, ISBN: 0521519152, 9780521519151

14CS3017 DESIGN AND ANALYSIS OF ALGORITHMS

Credits: 3:0:0

Objective:

- To provide an introduction to advanced algorithms and its complexities
- To analyse the efficiency of various algorithms using advanced algorithmic techniques
- To design efficient algorithms using various design techniques

Outcome:

The student will be able to

- analyze the correctness of algorithms using inductive proofs and loop invariants.
- analyze worst-case running times of algorithms using asymptotic analysis. Compare the asymptotic behaviors of functions obtained by elementary composition of polynomials, exponentials, and logarithmic functions. Describe the relative merits of worst-, average-, and best-case analysis.
- analyze average-case running times of algorithms whose running time is probabilistic. Employ indicator random variables and linearity of expectation to perform the analyses. Recite analyses of algorithms that employ this method of analysis.

Introduction to role of algorithms in computing –recurrences - probabilistic analysis and randomized algorithms-sorting techniques- elementary data structures-trees–dynamic programming - greedy algorithms-graph algorithms-introduction to linear programming.

Reference Books:

1. Thomas H.Cormen, Charles E.Leiserson, Ronald L.Rivest, Clifford Stein, Introduction to Algorithms, Third edition PHI Learning, 2010. ISBN: 10: 8120340078. ISBN: 8120321413.
2. Jeffrey Mcconnell, "Analysis of Algorithm", Jones and Battlet, 2008. ISBN-10: 0-7637- 0782-1.
3. A.V. Aho, J. E. Hopcroft and J. D. Ullman, "The Design and Analysis of Computer Algorithms", Pearson Education Asia, 2003.
4. Sara Baase and Allen Van Gelder, "Computer Algorithms - Introduction to Design and Analysis", Pearson Education Asia, 2003.
5. Michael T. Goodrich, Roberto Tamasia, Algorithm Design, First Edition, John Wiley and sons, 2001. ISBN: 0471383651

14CS3018 MOBILE AD HOC NETWORKS

Credits: 3:0:0

Objectives:

- To provide the students an expert guide to the fundamental concepts, design issues, solution to the issues and the architecture and protocols in ad o=hoc wireless networking.
- To give insight into the 3G and portray the major evolution from 2G schemes.

Outcome:

The students will be able to

- gain knowledge on the concepts and design issues of the architecture and the MANET protocols.
- gain insight into DECT, GSM, UMTS, 2G and 3G.

Ad Hoc Wireless Networks: Introduction, Issues, Ad Hoc Wireless internet, MAC protocols for Ad Hoc Wireless Networks: issues, design goals, classification, Routing protocols for Ad Hoc Wireless Networks: issues, classification, table-driven protocols, on-demand protocols, hybrid routing protocols, hierarchical, power-aware protocols, Quality of Service in Ad Hoc Wireless Networks, QoS routing, Energy Management, Wireless Sensor Networks, Evolution of wireless mobile technologies, 2G mobile systems, 2.5G mobile wireless systems, 3G mobile wireless system

Reference Books:

1. Murthy, Ad Hoc Wireless Networks : Architectures and Protocols, Dorling Kindersley, 2006, ISBN-13: 9788131706886
2. George Aggelou, Mobile Ad Hoc Networks from Wireless Lans to 4G Networks, Tata McGraw - Hill Education, 2009, ISBN-13: 9780070677487
3. C-K Toh, Ah Hoc Mobile Wireless Network Protocols and System, Dorling Kindersley, 2007, ISBN-13:9788131715109
4. Perkins, Ad Hoc Networking, Dorling Kindersley, 2008, ISBN-13: 9788131720967
5. Stefano Basagni, Marco Conti, Silvia Giordano, Ivan Stojmenovic, "Mobile Ad Hoc Networking", Wiley India Pvt Ltd, 2010, ISBN-13: 9788126527892
6. Gianluigi Ferrari, Ozan K. Tonguz, "Ad Hoc Wireless Networks: A Communication –Theoretic Perspective", Wiley, 2009, ISBN-13: 9788126523047

14CS3019 DISTRIBUTED SYSTEMS

Credits: 3:0:0

Objective:

- To introduce the concepts of resource sharing, system modeling, inter-process communication and file systems in distributed systems.

- To inculcate the skill sets in name services and global states, distributed transaction and concurrency control, distributed shared memory and distributed multimedia system.

Outcome:
The student will be able to
- obtain knowledge about the challenges and various design issues in distributed systems
- understand the different inter-process communication strategies
- understand the basic principles underlying the functioning of distributed systems

Introduction to distributed systems - challenges – architectural models - fundamental models - introduction to inter-process communications – external data representation- introduction to distributed objects - remote procedure call - events and notifications– case study - operating system support – distributed file system - file service architecture-name services and dns - directory services - peer-to-peer systems - middleware - routing overlays - synchronizing physical clocks - logical time and logical clocks - global states-introduction to coordination and agreement - distributed mutual exclusion - distributed transactions - atomic commit protocols - concurrency control - deadlocks – recovery-introduction to replication - fault tolerant services - distributed multimedia systems - distributed shared memory.

Reference Books:

1. George Coulouris, Jean Dollimore, and Tim Kindberg, Distributed Systems Concepts and Design, Fifth edition, Addison-Wesley, 2011. ISBN 0-13-214301-1.
2. Andrew S. Tanenbaum and Maartenvan Steen, Distributed Systems: Principles and Paradigms, Second edition, Prentice Hall, 2006. ISBN 0132392275.
3. Sukumar Ghosh: Distributed Systems, An Algorithmic Approach, first edition, Chapman and Hall / CRC, 2006. ISBN 1584885645
4. Pradeep K. Sinha: Distributed Operating Systems, Concepts and Design, PHI, 2007. ISBN 978-81-203-1380-4
5. Ajay D. Kshemkalyani, Mukesh Singhal, Distributed Computing: Principles, Algorithms, and Systems, Cambridge University Press, 2011, ISBN – 0521189845

14CS3020 GRID COMPUTING

Credits: 3:0:0

Objective:
- To understand the concepts of Grid Computing and the emerging technology standards on Grid infrastructure
- To expose on the prominent toolkits and middleware solutions that impact the Grid adoption.

Outcome:
The student will be able to
- predict the behavior of grid computing environment
- understand the working principles of grid applications and grid components

Grid Vs other Distributed Systems – Motivation for using Grid- Autonomic computing- Semantic Grids - Grid Architecture – Few Standards of Grid - Data Management in Grid Job Mapping and Scheduling – Service Monitoring and Discovery – Grid Workflow – Fault Tolerance in Grid – Meta Schedulers - Grid Security Infrastructure - Authentication – Authorization – Confidentiality – Delegation - Trust and Security - Elementary Services – Advanced Services - Types of Grid Middleware – OGSA – OGSI - Architectural Overview of GRID projects – GRID Enabling Applications.

Reference Books:

1. Frederic Magoules, Jie Pan, Kiat - An Tan, Abhinit Kumar, Introduction to Grid Computing, CRC Press, 2009. ISBN 978-1-4200-7406-2.

2. Barry Wilkinson, Grid Computing Techniques and Application, CRC Press, 2010. ISBN 978-1-4200-6953-2.
3. Frederic Magoules, Fundamentals of Grid Computing, CRC Press, 2010. ISBN: 978-1-4398-0367-7.

14CS3021 HIGH PERFORMANCE NETWORKS

Pre-requisites: 14CS2007 Computer Networks

Credits: 3:0:0

Objective:

- To develop a comprehensive understanding of network architectures, protocols, control, performance, and economies
- To focus on the convergence of the telephone, computer networking, cable TV, and wireless networks that explains current and emerging networking technologies.

Outcome:

The student will be able to

- describe and determine the Packet switched networks, circuit switched networks, Internet and TCP / IP Networks.
- develop the Wireless Network and control of networks
- describe and determine the ATM, Optical network and the various switching techniques.

Packet switched Networks - OSI and IP models -Internet and TCP/IP Networks - Circuit Switched Networks - SONET - Intelligent Networks - ATM- Addressing Signaling and Routing - Internetworking with ATM - Wireless Networks - Link level design - Channel access - Network design - Control of Networks - Control of Networks: Mathematical Background - Optical Networks- Optical Links - Optical LANs-Optical paths and Networks - Switching - Modular Switch Designs - Global Multimedia Network - Technology areas and Challenges.

Reference Books:

1. Walrand. J. Varaiya, High Performance Communication Network, Morgan Kaufmann- Harcourt Asia Pvt., Ltd., 2nd Edition, 2000, ISBN 15-5860-574-6.
2. Behrouz A. Forouzan, TCP/IP Protocol Suite, Tata McGraw Hill, Fourth Edition, 2006. ISBN: 0-07-060004.
3. J.F.Kurose and K.W. Ross, Computer Networking-A top-down approach featuring the internet, Addison Wesley, 4th Edition, 2007, ISBN 03-2149-770-8.
4. William Stallings, ISDN and Broadband ISDN with frame Relay and ATM, Pearson Education, 4th Edition, 2009, ISBN 8131705633.
5. Rainer Handel, Manfred N. Huber, Steffen Schroeder, ATM Networks, Concepts, Protocols Applications, Pearson Education, 3rd Edition, 2009, ISBN 8177585290.

14CS3022 COMPUTING SECURITY LAB

Co-requisite: 14CS3038 Security in Computing

Credits: 0:0:2

Objective:

To Implement

- Mono alphabetic ciphers
- Poly alphabetic ciphers
- Fiestel Cipher
- Symmetric key Encryption

- Public Key Encryption
- Cryptanalysis and Frequency analysis of ciphers
- Key management and exchange algorithms
- Digital Signatures and certificates
- Hashing algorithms
- Secure Electronic Transactions

Outcome:
The student will be able to
- Have in depth understanding of various cryptographic techniques used for secure data transmission.
- Comprehend the ciphers and their related security services.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3023 INFORMATION STORAGE MANAGEMENT

Pre-requisite: 14CS2011 Database Systems

Credits: 3:0:0

Objective:
- To evaluate storage architecture; understand logical and physical components of a storage infrastructure including storage subsystems
- To describe storage networking technologies such as FC-SAN, NAS, IP-SAN and data archival solution – CAS
- To identify different storage virtualization technologies and their benefits
- To understand and articulate business continuity solutions including, backup and recovery technologies, and local and remote replication solutions
- To define information security, and storage security domains
- To identify parameters of managing and monitoring storage infrastructure and describe common storage management activities and solutions

Outcome:
The student will be able to
- gain knowledge on the physical and logical components of a storage infrastructure and parameters of managing and monitoring storage infrastructure
- understand on different storage virtualization technologies and their benefits, information security and storage security domains

Introduction to information storage-Information Storage, Storage System Environment- RAID: Implementation of RAID – Hot Spares - Intelligent storage system- Direct Attached Storage and Introduction to SCSI-Storage Area Networks-FC Topologies – Network attached storage- General Purpose Servers vs NAS Devices -IP SAN-Fixed Content and -Storage Virtualization - Introduction to business continuity- Information Availability -Backup and Recovery-Local Replication-Remote Replication - Securing the storage infrastructure-Storage Security Framework-Managing the Storage Infrastructure-Developing an Ideal Solution

Reference Books:

1. EMC Corporation, Information Storage and Management, Wiley Publishing Inc. USA, 2009, ISBN 978-81-265-2147-0.
2. Tom Clark, Designing Storage Area Networks: A Practical Reference for Implementing Fibre Channel and IP SANs, Addison Wesley, Second Edition, 2003, ISBN 978-0321136503.
3. Robert Spalding, Storage Networks: The Complete Reference, Tata McGraw Hill, 2008, ISBN 978-0-07-053292.

4. Meeta Gupta,Storage Area Network Fundamentals,Cisco Press, 2002,ISBN 1-58705-065.

14CS3024 INTERNETWORKING

Credits: 3:0:0

Objective:

- To understand the layers of TCP/IP and how all protocols in the TCP/IP suite fit into the five-layer model.
- To understand the possibilities of interconnecting multiple physical networks into a coordinated system.
- To learn the details of the global TCP/IP internet including the architecture of its router system and the application protocols it supports.
- To learn the working principles of Multiprotocol Label Switching.

Outcome:

The student will be able to

- identify the various TCP/IP protocols that used for particular networking application
- identify the type of Interior and exterior routing protocol that used for different networks.
- understand the behavior of internetworking different networks in MPLS networks.

Introduction to TCP/IP - Layering - Link Layer – IP Internet Addresses - IP Internet Protocols-Address Resolution Protocol- Reverse Address Resolution Protocol - Internet Control Message Protocol - IP Routing - Dynamic Routing Protocols ,User Datagram Protocol –Broadcasting and Multicasting – IGMP – DNS – TFTP Protocol – BOOTP - TCP Protocol - SNMP Protocol -Telnet and Rlogin – FTP Protocol – SMTP Protocol – NFS Protocol - MPLS Switching Introduction - Label Switching Basics – Switching and Forwarding Operations – MPLS Key Concepts - Label Distribution Operations - MPLS and ATM and Frame Relay Networks - Traffic Engineering-OSPF in MPLS Networks.

Reference Book:

1. W. Richard Stevens, TCP/IP Illustrated Volume – I, The Protocols, Second Edition, Addison-Wesley, 2011. ISBN: 978-0321336316
2. Uyless Black, MPLS and Label Switching Networks, Pearson Education, Second Edition, 2002. ISBN: 81-7808-650-6.
3. Behrouz A. Forouzan, TCP/IP Protocol Suite, Tata McGraw Hill, Fourth Edition, 2009. ISBN: 978-0073376042
4. Douglas E. Comer, Internetworking with TCP/IP – Principles, Protocols and Architecture, Pearson Education, Fifth Edition, 2007. ISBN: 978-81-203-2998-0.

14CS3025 INTERNETWORKING AND SECURITY LAB

Co-requisite: 14CS3024 Internetworking, 14CS3038 Security in Computing

Credits: 0:0:2

Objective:

To simulate

- TCP/IP protocols
- virtual LAN, Ethernet and Wireless LAN
- networking routing protocols using Packet Tracer
- the IP Protocol using Packet Tracer
- subnetting and supernetting concepts

To Learn

- trouble shooting of networks

To implement

- various substitution and transposition ciphers

- symmetric key Encryption
- public Key Encryption
- key management and exchange algorithms
- authentication Algorithms

Outcome:
The student will be able to
- understand the functionalities of internetworking Protocols.
- learn about working functionalities of different computer networks
- practical Idea about subnetting and supernetting concepts.
- have in depth understanding of various cryptographic techniques used for secure data transmission.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3026 PATTERN RECOGNITION

Credits 3:0:0

Objectives:
- To understand the basics of Patterns recognition systems, Parameter and Non parameter estimation techniques.
- To know about Discrimination functions, Stochastic and Non-metric methods.
- To have knowledge on Algorithm independent Machine learning, Unsupervised learning and clustering in pattern recognition.

Outcome:
Students will
- be equipped with the knowledge of basic patterns recognition systems
- be able to know stochastic and non-metric methods.
- have knowledge on Algorithm independent Machine learning, unsupervised learning and clustering in pattern recognition.

Pattern Recognition Systems-Bayesian Decision Theory – Continuous Features -Normal Density -Discrete Features-Maximum Likelihood Estimation – Bayesian Parameter Estimation-Problems of Dimensionality - Component Analysis and Discriminations – Density Estimation – Linear Discriminant Functions and Decision Surfaces –Multi-category Generalizations- Stochastic Search – Evolutionary Methods – Genetic Programming - Decision Trees – CART - Mixture Densities and Identifiability – Unsupervised Bayesian Learning – Data Description and Clustering – Criterion Functions for Clustering.

Reference Books:

1. R.O.Duda, P.E.Hart and D.G.Stork, Pattern Classification, John Wiley, 2001. ISBN: 9814-12-602-0.
2. S.Theodoridis and K.Koutroumbas, Pattern Recognition, Academic Press, Fourth Edition, 2008. ISBN-10: 1597492728.
3. C.M.Bishop, Pattern Recognition and Machine Learning, Springer, First Edition, 2006. ISBN-10: 0387310738.
4. E. Gose, R. Johnsonbaugh, S. Jost, Pattern Recognition and Image Analysis, PHI,1997 (Digital Print - 2007). ISBN: 0132364158, 9780132364157
5. Earl Gose, Richard Johnsonbaugh, Steve Jost, Introduction to Pattern Recognition: A Matlab Approach, Academic Press, 2010. ISBN: 0080922759, 9780080922751.
6. Frank Y. Shih, Image Processing and Pattern Recognition: Fundamentals and Techniques, John Wiley and Sons, 2010, ISBN: 0470590408, 978047059040

14CS3027 SOFTWARE ARCHITECTURE RESTRUCTURING

Pre-requisite: 14CS3039 Software Architecture

Credits: 3:0:0

Objective:

- To change the software structure without affecting the behavior of system
- To improve the design of the code after it has been written
- To learn about the basics of software clustering

Outcome:

Students will be able to

- understand the principles of refactoring.
- understand the impact of refactoring on the design of a system
- understand the software clustering

Introduction to Refactoring, Principles in Refactoring and Bad Smells in Code, Moving Features Between Objects and Building Tests, Dealing with Generalization, Graph Clustering, Applications of Graph Clustering, Model-Driven Software Development, Modeling Concepts, Model Transformations, Architecture in Model-Driven Software Development, Interoperability Metamodels for Reengineering, Model-Driven Reengineering Approaches.

Reference Books:

1. Jay Fields, Shane Harvie, Martin Fowler, Kent Beck, Refactoring, First Edition, Addison- Wesley, 2009, ISBN : 978-0321984135.
2. Niels Streekmann, Clustering-Based Support for Software Architecture Restructuring, First Edition, Vieweg Teubner Verlag, 2011, ISBN : 978-3834819536.
3. Michael C.Feathers, Working Effectively with Legacy Code First edition, Pearson Education, 2004.
4. Robert C. Seacord, Daniel Plakosh and Grace A Lewis, Modernizing Legacy Systems: Software Technologies, Engineering Processes, And Business Practices. First Edition Pearson Education, 2003, ISBN : 978-0321118844.

14CS3028 NETWORK DESIGN AND MANAGEMENT LAB

Co-requisite: 14CS3008 Analysis, Architecture and Design of Networks

Credits: 0:0:2

Objective:

- To demonstrate the basics of designing a network, taking into consideration the users, services, and locations of the hosts.
- To demonstrate various protocol used in network, application and transport layer

Outcome:

The student will be able to

- acquire the knowledge of basic network management concepts
- compare and analyze various layers protocol
- gain practical knowledge on Network design, LAN and various layer protocols

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3029 NETWORK MANAGEMENT

Pre-requisite: 14CS2007 Computer Networks

Credits: 3:0:0

Objectives:

- To present the foundations of models which are needed to build various network management architectures and protocols.
- To provides exposure to SNMP-based protocols that manage TCP/IP networks with real-world examples.

Outcome:

The student will be able to

- acquire the knowledge of basic network management concepts, SNMPv1 Network management organization, Information models, communication and functional models
- compare and analyze SNMPv2 and SNMPv3
- gain theoretical background about RMON, network management tools and systems and web based management

Data Communications And Network Management Overview - Basic Foundations : Standard, Models and Languages - SNMPV1 Network Management – Organizational, Information, Communication and Functional Models - SNMP V2 Network Management - SNMPV3 Network Management - SNMP Management RMON – Network Management Tools, Systems and Engineering - Web Based Management

Reference Books:

1. Mani Subramanian, Network Management Principles and Practice, Addison Wesley, 2012. ISBN: 9788131727591.
2. Sebastian Abeck, Adrian Farrel, Network Management Know it all, Elsevier Morgan Caufmann, 2009. ISBN: 9780123745989.
3. Stephen B. Morris, Network Management, MIBs and MPLS: Principles Design and Implementation, Pearson, 2008. ISBN-10: 0131011138, ISBN-13: 9780131011137.
4. Alexander clemm, Network Management Fundamentals, CISCO Press, 2006. ISBN: 1587201372.
5. Andrew S.Tanenbaum, Computer Networks, Pearson Education, Limited, 2011.

14CS3030 3D MODELLING AND RENDERING

Credits: 3:0:0

Objectives:

- To learn 3D modelling and various approaches for visualizing models.
- To learn the fundamentals of texture mapping, methods for rendering the graphics scene and techniques used to composite images.
- To learn various lighting techniques for rendering the 3D scene.

Outcome:

Students will be

- able to know the concepts of 3D modelling and various approaches for visualizing models.
- be equipped with the knowledge of blending, transparency and lighting techniques for rendering the 3D scene.

Geometry Representation and Modeling - 3D Transformations - Data representation- Color, Shading and Lighting - Texture Mapping- Window System and Platform Integration - Multiple Rendering Passes- Antialiasing- Composting, Blending and Transparency - Basic Transform Techniques - Lighting Techniques

Reference Books:

1. Tom McReynolds, David Blythe, Advanced Graphics Programming Using OpenGL, Elseveir Publications, 2005, ISBN: 0080475728, 9780080475721.

2. Francis S. Hill, Stephen M. Kelley, Computer graphics using Open GL, Third Edition, Pearson Prentice Hall, 2007, ISBN: 0131362623, 9780131362628.
3. Donald Hearn, M. Pauline Baker, Computer Graphics with OpenGL, Third Edition, Pearson Education India, 2004 , ISBN: 8131727386, 9788131727386.
4. Nikos Sarris, Michael G. Strintzis, 3D Modeling and Animation: Synthesis and Analysis Techniques for the Human Body, Idea Group Inc (IGI), 2005, ISBN: 1591402999, 9781591402992
5. Tom Capizzi, Inspired 3D Modeling and Texture Mapping, , 2002, Cengage Learning ISBN: 1931841500, 9781931841504

14CS3031 OBJECT ORIENTED CASE TOOLS LAB

Credit: 0:0:2

Objective:

- To understand how to convert the system requirements to a design.
- To understand how to design the various functionalities of an object oriented software system.

Outcome:

The student will be able to

- modularize a software problem into sub units.
- design the various elements of the software.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3032 OBJECT ORIENTED SOFTWARE ENGINEERING

Pre-requisite: 14CS2042 Software Engineering

Credits: 3:0:0

Objective:

- To gain knowledge in both the principles of software engineering as well as the practices of various object-oriented tools, processes, and products.
- To design and construction of modular, reusable, extensible and portable software using object oriented programming languages.

Outcome:

The student will be able to

- understand basics of the software engineering process life cycle.
- understand the application of object-oriented approach to software development.
- understand Unified Modeling Language and the benefits of visual modelling / diagramming.
- practice the application of object-oriented principles for software development

Introduction to software engineering concepts: modeling with UML-project organization concepts – project communication concepts –analysis concepts -managing analysis-case study-system design concepts – case study-object design –reuse concepts – case study-mapping concepts – case study - configuration management - project management-IEEE 1074 –software life cycle models – methodologies

Reference Books:

1. Bernd Bruegge and Allen Dutoit, Object-Oriented Software Engineering: Practical software development using UML, Patterns and java, Third Edition, Pearson Education, 2009.ISBN-13: 9780136061250 .
2. Timothy C. Lethbridge and Robert Laganiere, Object-Oriented Software Engineering: Practical software development using UML and Java, McGraw-Hill Higher Education, 2005.ISBN: 0077109082.

3. Stephen R. Schach , Object-oriented and Classical Software Engineering, McGraw-Hill Higher Education, 2005, ISBN :0072865512
4. George Wilkie, Object-oriented Software Engineering: The Professional Developer's Guide,Addison-Wesley, 2003. ISBN-13: 9781580535274.
5. Bernd Bruegge and Allen H. Dutoit, Object-Oriented Software Engineering: Conquering Complex and Changing Systems**,** Pearson Education, 2002. ISBN 0-13-489725-0.

14CS3033 OPERATING SYSTEMS AND NETWORKING LAB

Co-requisite: 14CS3006 Advanced Operating Systems, 14CS3024 Internetworking

Credit: 0:0:2

Objective:

- To gain the practical knowledge about the operating system concepts such as CPU scheduling, synchronization problems, memory management.
- To gain the practical knowledge about the basic networking concepts such as TCP, UDP protocol, FTP, RMI.

Outcome:
The student will be able to

- understand the operating system concepts such as CPU scheduling, synchronization problems, memory management.
- implement the different types of network protocols.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester

14CS3034 INFORMATION SECURITY

Credits: 3:0:0

Objective:

- To provide students with an exposure about Security System Development Life Cycle.
- To provide knowledge about the fundamentals of information security, computer security technology and principles, access control mechanisms, software security, physical security, and security management and risk assessment

Outcome:
Students will be able to

- explain the challenges and scope of information security;
- explain the importance of cryptographic algorithms used in information security in the context of the overall information technology (IT) industry;
- describe the basic process of risk assessment in the context of overall IT security management.

Introduction to information security: Critical Characteristics of Information – NSTISSC Security Model – Components of an Information System – Securing the Components — The Systems Development Life Cycle –The Need for Security-Legal, ethical and professional issues in information security: Policy Versus Law – Ethical Concepts– Codes of Ethics, Certifications and Professional Organizations – Organizational Liability and the Need for Counsel. Risk Management– Risk Identification – Risk Assessment – Documentation - Risk management:
Risk Control Strategies – Risk Mitigation Strategy Selection – Categories of Controls –Risk– Recommended Practices in Controlling Risk-Blueprint for Security: Information Security Policy, Standards and Practices– Security Education, Training and Awareness Program – Design of Security Architecture-Planning for continuity: Strategy – Business Impact Analysis – Incident Response Planning – Incident Reaction – Incident Recovery – Automated Response – Disaster Recovery Planning – Business Continuity Planning – Model for a Consolidated Contingency

Plan – Law Enforcement Involvement-Security Technology: Physical Design of the SecSDLC – Firewalls – Dial-up Protection – Intrusion Detection Systems – Scanning and Analysis Tools – Content Filters – Trap and Trace – Cryptography and Encryption-based solutions – Access Control Devices-Physical security: Access Controls – Fire Safety – Failure of Supporting Utilities and Structural Collapse – Interception of Data – Mobile and Portable Systems-Security and Personnel: The Security Function within an Organization's Structure – Staffing– credentials– Employment Policies and Practices – Security Considerations for Nonemployees – Separation of Duties and Collusion – Privacy and the Security of PersonnelData.

Reference Book:

1. Michael E. Whitman, Herbert J. Mattord, Principles of Information Security, Thompson Course Technology, 2003. ISBN: 981-243-862-9.
2. Timothy P. Layton, Information Security Design, Implementation, Measurement and Compliance, Auerbach Publications, 2007. ISBN: 0-8493-7087-6.
3. Wenbo Mao, Modern Cryptography, First Edition, Pearson Education, 2008 ISBN: 978- 81-317-0212-3
4. Roberta Bragg, Mark Rhodes, Keith Strassberg, Network Security, Tata Mcgraw Hill Edition, 2008. ISBN-13: 978-0-07-058671-0
5. Charlie Kaufman, Radia Perlman, Mike Speciner, Network Security, Second Edition, Prentice Hall, 2002. ISBN: 81-203-2213-4.

14CS3035 REAL TIME SYSTEM SOFTWARE

Credits: 3:0:0

Objective:

- To understand the main underlying theoretical and practical problems.
- To validate formal specifications, in particular of real-time systems, with the aid of software tools for the verification and analysis.

Outcome:

The student will be able to

- identify the real time systems and process and state based systems model.
- classify the types of data flow diagrams and tabular languages
- forecast the behavior execution time prediction and measurement of software by software

The world of real time systems - software architecture-requirements and design specifications - systems of state machines -declarative specifications - deterministic scheduling-execution time prediction - keeping time on computers-programming languages - operating systems.

Reference Books:

1. C. M. Krishna, Kang G. Shin, Real-Time Systems, McGraw-Hill International Edition 2010. ISBN: 0-07-070115-6.
2. Jane W. S. Liu, Real-Time Systems, Pearson Education, Eighth Impression, 2009, ISBN: 978-81-7858-575-9.
3. Rob Williams, Real-Time Systems Development, Butterworth-Heinemann, 2005, ISBN0080456405
4. Phillip A. Laplante, Real-Time Systems Design and Analysis, Edition3, John Wiley and Sons, 2004 ISBN 0471648280
5. Alan C. Shaw, Real–Time Systems and Software, Wiley, 2002. ISBN: 9814-12-657- 8.

14CS3036 REAL TIME SYSTEMS

Credits: 3:0:0

Objective:

- To study the fundamental concepts, the algorithms and protocols for scheduling and validating of real-time systems.
- To learn the design and evaluation issues in real-time systems.

Outcome:
The student will be able to

- acquire knowledge to schedule periodic, Aperiodic and sporadic tasks.
- have the ability to understand the effects of practical factors while scheduling the tasks of the real-time system.
- apply the real-time scheduling knowledge in database and fault-tolerant system

Introduction to real time computing – hard versus soft real time systems – a reference model of real time systems - commonly used approaches to real time scheduling -clock-driven scheduling - priority-driven scheduling of jobs - scheduling aperiodic and sporadic jobs in priority driven systems - deferrable servers – sporadic servers – slack stealing approaches -basic priority inheritance protocol - priority ceiling protocol – preemption ceiling protocol- introduction to real-time databases – real-time vs. general-purpose databases – issues and solutions - databases for hard real-time systems - fault-tolerant techniques.

Reference Books:

1. Jane W.S. Liu, Real-Time Systems, Pearson Education, 2006. ISBN: 9788177585759.
2. C. M. Krishna, Kang G. Shin, Real-Time Systems 2009, McGraw-Hill International Edition. ISBN: 9780070701151.
3. Phillip A. Laplante, Real-Time Systems Design and Analysis, Prentice Hall of India, Third Edition, 2006. ISBN 9788126508303.
4. Real-Time Systems Design and Analysis: Tools for the Practitioner Phillip A. Laplante, Seppo J. Ovaska, Fourth Edition, John Wiley and Sons, 2011, ISBN-1118136594
5. Rob Williams, Real-Time Systems Development, Butterworth-Heinemann, 2005 ISBN- 0080456405
6. Albert M. K. Cheng , Real-Time Systems: Scheduling, Analysis, and Verification, John Wiley and Sons, 2003 ISBN-0471460842

14CS3037 REQUIREMENTS ENGINEERING

Pre-requisite: 14CS2042 Software Engineering

Credits: 3:0:0

Objective:

- To give a general introduction to the requirement engineering process.
- To know different approaches to model requirement engineering process.
- To understand the importance of human, social and organization factors influence those processes.

Outcome:
The student will be able to

- improve the capability of gathering requirement for projects.
- identify factors involved for requirement engineering.
- classify the types of requirements needed for project.
- understand how requirements engineering leads towards a good design.

The essential software requirement - requirements from the customer's perspective - good practices for requirements engineering –requirements development process –requirements analyst-establishing the product vision and project scope – finding the voice of the customer- understanding user requirements-documenting the requirements - the data dictionary –modeling the requirements diagrams – decision tables and decision trees-requirements management principles and practices - the change control process –links in the requirements chain - tracing requirements - improving requirements processes - software requirements and risk management

Reference Books:

1. Karl E. Wiegers, Software Requirements, WP Publishers and Distributors Private Limited, 2005. ISBN: 81-7853-071-6.

2. Elizabeth Hull, Ken Jackson, Jeremy Dick, Requirements Engineering, Second Edition, Springer Publication, 2005. ISBN: 1852338792, 9781852338794.
3. Murali Chemuturi Requirements Engineering and Management for Software Development Projects, Springer, 2012, ISBN : 1461453763
4. Ralph R. Young, Effective Requirements Practices, Addison Wesley, 2001. ISBN: 0-201-70912-0.
5. Richard H. Thayer, Merlin Dorfman, Sidney C. Bailin, Software Requirements Engineering, Second Edition, Wiley, 1997 Digitized 2009, ISBN: 0818677384

14CS3038 SECURITY IN COMPUTING

Credits: 3:0:0

Objective:

- To understand the security threats in computing and to learn necessary control measures.

Outcome:

The student will be able to

- design trusted operating systems.
- obtain the knowledge on multilevel database and security.
- learn the possibilities in securing the network.

Introduction to security in computing – introduction to elementary cryptography - Program security – Protection in general purpose operating systems – Designing trusted operating systems –database and data mining security-security in networks-administering security.

Reference Books:

1. Charles P. Pfleeger, Shari Lawrence Pfleeger, Security in Computing, Fourth Edition, Pearson Education, 2006. ISBN: 0-13-239077-9.
2. Dieter Gollmann, Computer Security, Second edition, John Wiley and Sons, 2006. ISBN:81- 265-0690-3.
3. William Stallings, Cryptography and Network Security, Fourth edition, Prentice Hall, 2006. ISBN: 0-13-147954-7.
4. Paul Campbell, Ben Calvert, Steven Boswell, Security + In Depth, International Student Edition, and 2005. ISBN: 0-619-21566-6.
5. John Aycock, Computer Viruses and Malware, Springer, 2006, ISBN: 0387302360.
6. Bruce schneier, Applied Cryptography, Second Edition, John Wiley and Sons, 2002. ISBN: 9971-51-348-X.

14CS3039 SOFTWARE ARCHITECTURE

Credits: 3:0:0

Objective:

- To learn about the concepts, principles, and state-of-the-art methods in software architectures
- To learn about the role of the architects, including domain-specific software architectures
- To learn about the various architectural styles, architecture description languages
- To know about the software connectors and architecture-based testing and analysis.

Outcome:

The student will be able to

- familiar with various software architecture
- use various description languages
- do Architecture-based testing and analysis

Introduction of software architecture : architectural styles – pipes and filters – layered systems and repositories-other architectures - case studies: instrumentation software – mobile robotics – cruise control-shared information systems:

database integration – architectural structures for shared information systems – the quantified design space-formal models and specification: formalizing architectural style and design space - linguistic issues – first class connectors-tools for architectural design : a universal connector language – exploiting style in architectural design environments – education of software architects – evaluation

Reference Books:

1. Mary Shaw and David Garlan, Software Architecture: Perspectives on an Emerging Discipline, Prentice-Hall, 2005. ISBN: 82-203-1470-0.
2. Richard N. Taylor, Nenad Medvidovic and Eric Dashofy, Software Architecture: Foundations, Theory, and Practice, Wiley 2008. ISBN: 978-0-470-16774-8.
3. Len Bass, Paul Clements, and Rick Kazman, Software Architecture in Practice, Third Edition, 2012. ISBN: 0321815734.
4. Peter Eeles, Peter Cripps, The Process of Software Architecting, Addison-Wesley, 2007. ISBN: 978-0-321-35748-9.
5. George Fairbanks, David Garlan, Just Enough Software Architecture: A Risk-Driven Approach, Marshall and Brainerd, 2010, ISBN:0984618104

14CS3040 ENTERPRISE SERVICE ORIENTED ARCHITECTURE

Credits: 3:0:0

Objective:

- To align the business architecture, the application architecture, and the technology architecture using a framework that allows all aspects to understand each other.
- To manage complexity, simplify development, promote reuse, improve productivity and increase flexibility.

Outcome:

Students will be able to

- design and build systems to support a dynamic business environment.
- dynamically add new capabilities which can help reduce development costs and almost eliminate traditional development cycles.
- will be able to handle business events from disparate sources.

Introduction to Enterprise Service-Oriented Architecture, Building Blocks of SOA Middleware, Model-Driven Business Process Development, Components of SOA Middleware, Interaction Models for SOA Middleware, Developing an Enterprise Service, Developing an Enterprise Service – Based Consumer Application, Configuring an Enterprise Service–Based Scenario, Standards for Service-Oriented Architectures.

Reference Books:

1. Falter, Thomas Fiedler, Martin Huvar, and Alexander Zubev, Developing Applications With Enterprise SOA, First Edition, SAP PRESS, 2008, ISBN-13: 978-1592291786.
2. James McGovern, Oliver Sims, Ashish Jain, Mark Little, Enterprise Service Oriented Architectures: Concepts, Challenges, Recommendations, First Edition, Vieweg Springer, 2006, ISBN-13: 978-1402037047.
3. Dan Woods, Thomas Mattern, Enterprise SOA: Designing IT for Business Innovation, First Edition, O'Reilly Media, 2006, ISBN-13: 9788184041446.

14CS3041 SOFTWARE METRICS AND QUALITY MANAGEMENT

Pre-requisite: 14CS2042 Software Engineering

Credits: 3:0:0

Objective:

- To understand how to choose appropriate quality goals and to select, to plan, and to execute quality assurance activities throughout development and evolution to predictably meet quality and schedule goals.
- To study the software quality engineering metrics and models

Outcome:

The student will be able to

- employ software metrics and models in software development
- select the best quality assurance plan during development

Overview of software metrics : the basics of measurement – goal based paradigms - empirical investigation - formal experiments-software size – complexity - measuring internal product attributes : software size – measuring internal product attributes - measuring cost and effort - cost models-software external product attributes : quality - measuring software reliability - software test metrics – the elements of a software quality system : standards - reviews - testing - defect analysis - configuration management - associated quality concerns -software safety : risk management - software documentation - quality system implementation

Reference Books:

1. John W. Horch, Practical Guide to Software Quality Management, Second Edition, Artech House Computer Library, 2003.
2. Stephen H. Kan, Metrics and Models in Software Quality Engineering, Second Edition, Pearson, ISBN: 813170324x, 2003.
3. John C. Munson, Software Engineering Measurement, Auerbach Publications, 2003.ISBN: 0849315034.
4. N.E. Fenton and S.L. Pfleeger, Software Metrics: A Rigorous and Practical Approach, Second Edition, PWS Publishing, 1998. ISBN 0-534-95425-1.
5. Gerald M. Weinberg, Quality Software Management: Anticipating Change, Dorset House Publishing Company,1997.
6. B A Kitchenham, Software Metrics: Measurement for Software Process Improvement, Blackwell Pub, 1996. ISBN: 1855548208.

14CS3042 SOFTWARE PROJECT MANAGEMENT

Pre-requisite: 14CS2042 Software Engineering

Credits: 3:0:0

Objectives:

- To understand Traditional Project Management, Resource Requirements and Cost.
- To create project Management Life Cycles and Strategies.
- To build an effective Project Management Infrastructure.

Outcome:

The student will be able to

- understand the developing high quality software systems, principles, concepts and techniques associated with software development.
- analyze and evaluate problems and draw on the theoretical and technical knowledge to develop and implement plans for their resolution.

Introduction to Software Project Management –Understanding the Project Management Process Groups - How to Scope a Project – Defining and sing Project Management Process Groups - How to Plan a Project-How to launch a Project-How to Monitor and Control a Project-How to close a Project – Establishing Project Management Life Cycles and Strategies - Project Management Landscape - Traditional Project Management - Using Critical Chain Project Management-Agile Project Management - Building an effective Project Management Infrastructure - Establishing and Maturing a Project Support Office- Project Portfolio Management - Project Management Concepts-Process and Project Metrics - Estimation for Software Projects - Project Scheduling -Risk Management - Maintenance and Reengineering.

Reference Books:

1. Robert K. Wyzocki, Rudd McGary, Effective Project Management, Fifth Edition, WILEY-Dreamtech India Pvt. Ltd., 2009. ISBN: 978-81-265-2156-2.
2. Roger S Pressman, Pressman Roger, Software Engineering: A Practitioner's Approach, Seventh Edition, McGraw-Hill Higher Education, 2009. ISBN: 0073375977, 9780073375977.
3. Pankaj Jalote, Software project management in practice, Addison-Wesley, 2002. ISBN: 0201737213, 9780201737219.
4. Walker Royce "Software Project Management – A Unified Framework ", Pearson Education, 2004. ISBN: 0201309580, 9780201309584.
5. Bob huges, Mike cotterell, "Software Project Management", Tata McGraw Hill, New Delhi, 2006, Edition: 4,ISBN: 13 978-0-07-710989-9, 10 0077109899.

14CS3043 SOFTWARE TESTING

Credits: 3:0:0

Objective:

- To understand the basics of software testing and its strategies.
- To learn about software quality evaluation policies and procedures
- To give adequate knowledge on various testing methodologies.

Outcome:

The student will be able to

- predict the behavior of defects, hypotheses and tests.
- identify the types of test goals, policies plans, and documentation.

Testing fundamentals – defects, hypotheses and tests – strategies and methods for test case design - levels of testing – test goals, policies plans and documentation-controlling and monitoring the testing process – reviews as a testing activity-evaluating software quality– defect analysis and prevention-process control and optimization – the testing maturity model and test process assessment.

Reference Books:

1. William E. Perry, Effective Methods for Software Testing, Third Edition, John Wiley, 2006.ISBN: 978-0764598371.
2. Srinivasan Desikan, Gopalaswamy Ramesh, Software Testing: Principles and Practice, Pearson Education India, 2006, ISBN-817758121X
3. Brian Hambling, Angelina Samaroo¸Software Testing, Publisher BCS, The Chartered Institute, 2009, ISBN – 1906124132
4. Ilene Burnstein, Practical Software Testing, Springer International, 2003. ISBN: 81-8128-089-X.
5. Elfriede Dustin, Effective Software Testing, Pearson Education, 2003. ISBN: 81-297-0048-4.

14CS3044 SOFTWARE TESTING LAB

Co-requisite: 14CS3043 Software Testing

Credit: 0:0:2

Objective:

- To understand the basics of software testing and its strategies.
- To learn about software quality evaluation procedures
- To understand various testing strategies

Outcome:

The student will be able to

- test a application program using various check points.
- perform various testing strategies on a given application program.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3045 SOFTWARE AGENTS

Credits: 3:0:0

Objective:

- To introduce the concept of agents, multi-agent systems and the key issues surrounding the design of intelligent agents.
- To design multi agent society and develop applications for agent technology.

Outcome:

The student will be able to

- gain knowledge about agents and multi-agents
- develop complex applications using multi-agents

Intelligent autonomous agents: introduction - intelligent agents – deductive reasoning agents-reasoning agents: practical reasoning agents – reactive and hybrid agents – multi-agent interactions – making group decisions-multi-agent decision making: forming coalitions – allocating resources – bargaining – argumentation-communication and cooperation: communication languages – cooperative distributed problem solving - task sharing and result sharing - coordination – multi-agent planning and synchronization-programming with JADE : The JADE platform - basic features.

Reference Books:

1. Michael Wooldridge, An Introduction to Multi Agent Systems, Second Edition, John Wiley and Sons Ltd, 2009. ISBN: 978-0-470-51946-2.
2. Fabio Bellifemine, Giovanni Caire, Dominic Greenwood, Developing Multiagent Systems with JADE, John Wiley and Sons Ltd, 2007. ISBN: 978-0-470-05747-6.
3. Gerhard Weiss, Multiagent Systems (Intelligent Robotics and Autonomous Agents series), MIT Press, Second Edition, March 2013. ISBN - 13: 978-0262018890.
4. Yoav shoham, Kevin Leyton-Brown, Multiagent Systems: Algorithmic, Game- theoretic and Logical Foundations,Cambridge University Press, December 2008. ISBN-13: 978-0521899437.
5. Yoav Shoham, Kevin Leyton-Brown Multiagent Systems: Algorithmic, Game-Theoretic, and Logical Foundations, Cambridge University Press, 2009, ISBN113947524X

14CS3046 SYSTEM ADMINISTRATION

Credit 3:0:0

Objective:

- To guide through the basics of Linux Technology and to train as a System Administrator
- To understand the structure of the Linux file system and how to work in the file system.
- To learn how to work with Linux shell and command line interface.
- To familiarize Kernel Components and System Management.
- To establish a Network and Secure Network Services.
- To learn how to manage software with RPM.

Outcome:

The student will be able to

- gain in-depth knowledge on the working of Linux systems
- work on Linux system and to locate additional utilities, configurations and maintenance.
- demonstrate a working knowledge of networking terms and concepts pertaining to system administration.

Introduction to Linux – GNOME desktop environment – locate and use help resources – Manage the Linux file system – File operation with Nautilus - Linux shell and Command line interface –Administer Linux with YaST – Manage users, groups and permissions – Manage software for Linux - Linux installation (SLES and SLED) – manage system initialization –Automate tasks - Administer Linux processes and services –administer the Linux file system – manage hardware - Configure the network – configure remote access – Monitor Linux system – manage backup and recovery – administer user access and system security

Reference Books:

1. Suse Linux, Novell Inc., USA.
2. Nicholas Wells, The Complete Guide to LINUX System Administration, Indian Edition, Cengage Learning, 2005, ISBN:0619216166.
3. Evi Nemeth, Garth Snyder, Trent R. Hein , Linux administration handbook, Second Edition, Pearson Education, 2007, ISBN 0-13-148004-9.
4. Tom Adelstein, Bill Lubanovic, Linux System Administration, O'Reilly Media Inc., First Edition, 2007, ISBN -13:978-0-596-00952-6.
5. Evi Nemeth, Garth Snyder, Trent R. Hein, Ben Whaley, Unix and Linux System Administration handbook, Fourth Edition 2010, Pearson Education, ISBN 0132117363

14CS3047 SYSTEM ADMINISTRATION LAB

Co-requisite: 14CS3046 System Administration

Credit 0:0:2

Objective:

- To learn about SUSE Linux Enterprise.
- To manage system initialization
- To administer Linux processes and services.
- To administer storage
- To configure the network
- To manage hardware
- To configure remote access
- To monitor SUSE Linux Enterprise system

Outcome:

The student will be able to

- efficiently use of SUSE Linux in productive environment

- do SUSE Linux Networking
- work with Linux shell and command line interface
- administer Linux with Yast.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3048 SYSTEM DEVELOPMENT LAB

Co-requisite: 14CS3032 Object Oriented Software Engineering

Credits: 0:0:2

Objective:

- To learn how to develop an application using different life cycle models
- To learn how to carry out requirement dictation process
- To learn architectural and detailed design methods
- To learn verification and validation techniques

Outcome:
The student will be able to

- understand the software lifecycle models
- identify the various requirements in a system
- understand about implementation of design methods
- perform verification and validation of the project

The faculty conducting the laboratory will prepare a list of 12 experiments and
get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3049 INFORMATION SECURITY AUDIT AND ASSURANCE

Credits: 3:0:0

Objective:

- To introduce the basic concepts of Information Security.
- To introduce new approaches to solve a wide variety of research-oriented problem.

Outcome:
Student will be able to

- propose best practices which utilize the means and methods of disguising information in order to protect confidentiality and integrity.

Information Technology Environment: Controls and Audit – Audit and Review: It's Role in Information Technology – The Audit Process in an Information Technology Environment-Auditing IT Planning and Organization**:** IT strategy and standards - Planning and Controlling – Project Management - Quality Management. Auditing IT Acquisition and Implementation: Software Acquisition – System implementation - Application Risk and Controls – change management. Auditing IT Operation from Standalone to Global: Complexities and Control Issues – Operational Control Issues –Assessing Risk in IT Operations – Audit methods and techniques for operations. Emerging issues in IT Audit. The legal environment and its impact on information technology**:** From IT Crime Law to IT Contract Law to Netlaw – Security and Privacy of Information Technology– IT Auditing.

Reference Book

1. Frederick Gallegos, Sandra Senft, Daniel P. Mason, Carol Gonzales, Information Technology Control and Audit, Auerbach Publications, Fourth Edition, 2012. ISBN-13: 9781439893203.
2. Nina Godbole, Information systems security: security management, metrics, frameworks and best practices, Wiley India Pvt Ltd, 2012. ISBN-13: 9788126516926
3. Jagdish Pathak, Information Technology Auditing: an Evolving Agenda, Springer, 2005. ISBN-13: 9783540221555.

14CS3050 WIRELESS NETWORKS LAB

Credits: 0:0:2

Objective:

- To simulate various communication and mobility models of wireless Networks
- To understand the characteristics of wireless MAC Protocols.
- To analyze the performance of various wireless routing protocols.
- To give hands on experience on protocol analyzer.

Outcome:

The student will be able to

- introduce various wireless systems and standards and their basic operation cases
- learn to simulate wireless networks and analyze the simulation results
- explain a network topology, including addressing, subnet masks, the use of internetworking devices, and configuring clients for the network.
- build basic networks using selected protocols and technologies, including internetworking with routers and routing protocols.
- demonstrate knowledge and application of protocols.
- create novel mechanisms and systems for supporting mobile computing and communications including wireless communication architectures, mobile/wireless TCP and wireless LAN; multimedia sensor networks and mobile ad-hoc networks.
- **e**xplore the characteristics of mobile ad hoc networks and analyze the performance of different routing and power-saving algorithms for mobile/wireless networks.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3051 WIRELESS SENSOR NETWORKS

Pre-requisite: 14CS2007 Computer Networks

Credits: 3:0:0

Objective:

- To gain knowledge about the applications of wireless sensor networks
- To learn the technologies and protocols used
- To gain insight on managing the wireless sensor network

Outcome:

The student will be able to

- predict the working procedure of a Wireless Sensor Network
- identify the Basic components needed for Wireless Sensor Network
- understand the knowledge of simulators and operating systems for wireless sensor network

Introduction and Overview of Sensor Network Technology - Applications of Sensor Networks - Category 1 and Category 2 - Taxonomy of WSN Technology - Sensor Node Technology - Sensor Taxonomy-WN Operating Environment-WN Trends - Wireless Transmission Technology and Systems - Available Wireless Technologies - Fundamentals of MAC Protocols - MAC Protocols for WSNs – Case Study: Sensor-MAC and IEEE 802.15.4 LR - WPANs Standard - Data Dissemination and Gathering - Routing Strategies - Transport Control Protocols and its Performance - WSN Middleware Principles - Network Management Models - Management Architecture: MANNA – Operating Systems for Wireless Sensor Networks - Future Trends in WSN.

Reference Books:

1. Kazem Sohraby, Daniel Minoli and Taieb Znati, Wireless Sensor Networks: Technology, Protocols, and Applications**,** John Wiley and Sons, 2007, 978-0471743002.
2. Jun Zheng, Abbas Jamalippur, Wireless Sensor Networks: A Networking Perspective, John Wiley and Sons, 2009, 978-0-470-16763-2.
3. Walteneous Dargie, Christian Poellabauer, Fundamentals of Wireless Sensor Networks: Theory and Practice, John Wiley and Sons, 2010, 978-0-470-997659.
4. Holger Karl and Andreas Willig, Protocols and Architectures for Wireless Sensor Networks, John Wiley and Sons, 2007, 978-0471718161**.**

14CS3052 CLOUD COMPUTING

Credits: 3:0:0

Objective:

- To provide an insight into the evolution of Cloud Computing.
- To impart basic knowledge on Architecture of Cloud Computing.
- To overview security issues in Cloud Computing implementations
- To introduce various cloud application, developmental tools and standards.

Outcome:

Student will be able to

- understand cloud Computing and various Cloud Architectures
- insight the security threats pertaining to cloud.
- learn various existing cloud applications.

The Emergence of Cloud Computing - Cloud based service offerings - Grid Computing Vs Cloud Computing - Key characteristics - Challenges for the cloud- Hardware and software Evolution - Server Virtualization - Services delivered over Cloud - Cloud computing infrastructure models-Architectural layers of Cloud computing-Cloud application programming interfaces-CPU virtualization-storage virtualization-Network virtualization -Case Study-Amazon EC2, S3, DB, Queues, Cloud Front - Security Issues In Cloud Computing-Cloud Security Challenges – Software as a Security - Distributed Management Task Force - Standards for Application Developers - Standards for Messaging - Standards for Security - Role of Virtualization in the Cloud - Cloud Computing Applications-YouTube- YouTube data API, Zimbra- Facebook- Zoho –MapReduce- Google paper -Big Tables –GFS – HDFS - Hadoop Framework.

Reference Books:

1. Cloud Computing - Implementation, Management and Security, John W. Rittinghouse, James F. Ransome, CRC Press, 2010.
2. Tom White, Hadoop the Definite Guide, O'REILLY, 2009
3. Judith Hurich, Robin Bloor, Marcia Kaufman, Fern Halper, Cloud Computing for Dummies, Wiley Publication Inc., 2010.
4. George Reese, Cloud Application Architectures, O'REILLY, 2009.
5. Tim Mather, Subra Kumarasamy, Shahed Latif, Cloud Security and Privacy, O'REILLY, 2009.
6. Introduction to Cloud Computing Architecture, White paper, SUN, Microsystems, 1st edition, June 2009.
7. Cloud Computing Specialist Certification kit.

14CS3053 DATA WAREHOUSE

Pre-requisite: 14CS2011 Database Systems

Credits: 3:0:0

Objective:

- To understand different methods for handling unstructured data in a data warehouse.
- To learn the techniques to store the data across multiple storage media.
- To examine Relational and Multidimensional Models.
- To explore advanced topics, including data monitoring and testing.

Outcome:

Students will be able to

- learn techniques to store data in storage media
- learn methods for handling data in a data warehouse

Evolution of Decision Support Systems - The Data Warehouse Environment – The Data Warehouse and Design-Granularity in the Data Warehouse - The Data Warehouse and Technology – The Distributed Data Warehouse-Executive Information Systems and The Data Warehouse – External Data and The Data Warehouse – Migration to the architectural Environment-The Data Warehouse and the Web – Unstructured Data and The Data Warehouse – The Really Large Data Warehouse-The Relational and the Multidimensional Models as a Basis for Database and design – Advanced Topics in the Data Warehouse.

Reference Books:

1. William H.Inmon, Building the Datawarehouse, Wiley Dreamtech (P) Ltd, Fourth Edition,Reprint 2010, ISBN:81-265-0645-8.
2. Claudia Imhoff ,Nicholas Galenno, Jonathan G.Geiger, Mastering data warehouse design, Wiley Publishing, First Edition, 2003,ISBN:81-265-0365-3.
3. Paulraj Ponniah, Data Warehousing Fundamentals – A Comprehensive guide for IT Professionals, John Wiley and Sons, Second Edition, 2010, ISBN:978-0-470-46207-2.

14CS3054 DATABASE SECURITY

Pre-requisite: 14CS2011 Database Systems

Credits: 3:0:0

Objectives:

- To learn the security issues pertaining with database servers.
- To survey the security problems existing in popular database systems.
- To know about various database securing technique

Outcome:

Students will be able to

- secure database systems in their network
- audit a customer's network for database security problems.

Need for Database Security, Oracle architecture, Attacking Oracle, Oracle: Moving Further into the Network, Securing Oracle-IBM DB2 Universal Database, DB2 Discovery, attack, Defense, Securing DB2.Informix: Information Architecture, Informix: Discovery, attack, defense, Securing Informix-Sybase Architecture, Sybase: Discovery, Attack, and Defense, Moving further into the network, Securing Sybase-MySQL Architecture, Discovery, attack and Defense, MySQL: Moving further into network, Securing MySQL-SQL server Architecture, Exploitation, Attack, Defense, Securing SQL Server.

Reference Books:

1. David Litchfield, John Heasman, Defending Database Servers-The Database Hacker's Handbook, Wiley Dreamtech India (P) Ltd, 2005,ISBN: 81-265-0615-6.
2. Ron Ben Natan, Implementing Database Security and Auditing, Elsevier, 2005. ISBN: 81-312- 0134-1.
3. Ramez Elmasri, Navathe, "Fundamentals of Database System", Sixth Edition, 2011. ISBN: 10-0-136-08620-9,ISBN: 978-0-135-08620-8.

14CS3055 INTERACTIVE GAME DESIGN

Credits: 3:0:0

Objective:

- To learn the concepts of designing a game and the role of a Game Designer.

Outcome:

Students will be

- equipped with knowledge on the role of game designer, and game designing.
- able to acquire knowledge about the formal and dramatic elements of game design

Introduction – Game Design Basics: The role of the game Designer- The Structure of Games – Designing a Game I: Working with formal elements- Working with Dramatic elements - Working with system Dynamics – Designing a Game II: Conceptualization- Prototyping- Digital Prototyping – Working as a Game Designer I: Play Testing- Functionality, Completeness and Balance- Fun and Accessibility – Working as a Game Designer II: Team Structure- Stages of Development –The Design Document

Reference Books:

1. Fullerton, Tracy, Game Design Workshop: A Playcentric Approach to Creating Innovative Games. Morgan Kaufmann, 2nd Edition, Elsevier, February 2008, ISBN: 0240809748, 9780240809748.
2. Jesse Schell, The Art of Game Design: A book of lenses, 1st Edition, Elsevier, 2008, ISBN: 9780123694966
3. Scott Rogers, Level Up!: The Guide to Great Video Game Design, 1st Edition, John Wiley and Sons, 2010, ISBN: 9780470688670
4. Richard Rouse, "Game Design: Theory and Practice", Second Edition, Jones and Bartlett Learning, 2010, ISBN: 9781449633455
5. Lewis Pulsipher, "Game Design: How to Create Video and Tabletop Games, Start to Finish", McFarland, 2012, ISBN: 0786491051, 9780786491056

14CS3056 INTERNETWORKING MULTIMEDIA

Credits: 3:0:0

Objective:

- To identify and analyze the requirements that a distributed multimedia application may enforce on the communication network.
- To include all the important aspects that has significant impact on the enhancements to the basic Internet architecture and its associated protocols.

Outcome:

Students will be able to

- identify internetworking principles and issues in multimedia technologies, difference between different network service mode and to describe how multicasting on the Internet works
- acquire knowledge on how session directories, advertisement and invitation protocols work.
- understand security measures and policies suitable for multicast multimedia.

Introduction - A brief history of real -Internet Service models-Multicast in the internet- Application other than Audio and Video Network Service Models-Resource reservation protocol (RSVP), -IP and ATM - Multicast, coding and compression- Host Functions -Calling down traffic on a Site Coding And Compression -Processing requirements for video Compression - Transport protocols, session directories, advertisement and invitation protocols-Advertisement And Invitation Protocols-Section initiation protocol (SIP)-Conference Controls Applications-Shared applications in the Mbone-Distributed virtual reality -Distributed virtual reality multicast protocol (DVRMP) - Media-on-demand, security and policy in multicast multimedia- Remote control of playback Security And Policy In Multicast Multimedia.

Reference Books:

1. Jon Crowcroft, Mark Handley, Ian Wakeman, Internetworking Multimedia, Publisher: Morgan Kaufmann; Illustrated Edition, 1999, ISBN: 1558605843.
2. Jenq –Neng Hwang,Multimedia Networking From Theory to Practice,Cambridge University Press,2009,ISBN 978-0-521-88204-0
3. B.O. Szuprowicz, Multimedia Networking, McGraw Hill, NewYork. 1995. ISBN-13: 978-0070631083
4. Tay Vaughan, Multimedia Making it work, Sixth Edition, Tata McGraw-Hill, 2003. ISBN-13: 978-0072230000.

14CS3057 MULTIMEDIA DATABASE

Pre –requisite: 14CS2011 Database Systems

Credits: 3:0:0

Objective:

- To study the design, indexing and retrieval of centralized and distributed Multimedia Database.
- To introduce trends in Multimedia Data Management and Mining used for Electronic Enterprise.

Outcome:

Students will be

- equipped with knowledge on the concepts on Distributed Multimedia Database, video indexing and retrieval techniques
- able to implement the text document and retrieval techniques

Introduction To Multimedia Database, Text Document Indexing And Retrieval, Video Indexing And Retrieval, System Support For Distributed Multimedia Databases - Measurement Of Multimedia Information Retrieval Effectiveness, Security and Privacy Considerations for Managing and Mining Multimedia Databases, , Prototypes and Products for Multimedia Data Management and Mining

Reference Books:

1. Guojun Lu, Multimedia Database Management Systems, Illustrated Edition, Artech House Publishers, 1999 (digitized 2009). ISBN: 0890063427, 9780890063422.
2. Bhavani M. Thuraisingham, Managing and Mining Multimedia Databases, First Edition, CRC Press, 2001. ISBN: 0849300371, 9780849300370
3. Lynne Dunckley, Multimedia Databases, First Edition, Addison-Wesley, 2003. ISBN :0201788993, 9780201788990.
4. Chabane Djeraba, Multimedia Mining: A Highway to Intelligent Multimedia Documents, Springer, 2003, ISBN: 1402072473, 9781402072475
5. Kingsley C. Nwosu, Bhavani M. Thuraisingham, P. Bruce Berra, Multimedia Database Systems, First Edition, Springer, 1996. ISBN: 0792397126, 9780792397120.

14CS3058 VIRTUAL REALITY TECHNOLOGY

Credits: 3:0:0

Objective:

- To learn the fundamental principles of virtual reality
- To learn virtual reality hardware and software
- To design and construct a simple virtual environment

Outcome:

Student will be able

- predict the behavior of any virtual reality hardware
- understand the type of software used for particular virtual reality hardware
- construct a simple virtual environment depending upon the requirement

Introduction and input devices: trackers,navigation,and gesture interfaces - output devices: graphic graphics, three-dimensional sound, and haptic displays - computing architecture of VR modelling and VR programming - human factors in vr, virtual reality softwares and applications

Reference Books:

1. Grigore C.Burdea and Philippe Coiffet, Virtual Reality Technology, Second Edition, John Wiley and Sons , 2006. ISBN: 8126507896, 9788126507894.
2. Gerard Kim, Designing Virtual Reality Systems: The Structured Approach, Springer, 2007, ISBN: 1846282306, 9781846282300
3. John Vince, Introduction to Virtual Reality, Springer, 2004, ISBN: 1852337397, 9781852337391
4. William R. Sherman, Alan B. Craig, "Understanding Virtual Reality: Interface, Application, and Design, Morgan Kaufmann publisher, 2003, ISBN: 1558603530, 9781558603530
5. Alan B. Craig, William R. Sherman, Jeffrey D. Will, Developing Virtual Reality Applications: Foundations of Effective Design, Morgan Kaufmann, 2009, ISBN: 0080959083, 9780080959085

14CS3059 WEB SERVICES

Credits: 3: 0: 0

Objectives:

- To understand web service technology and usage.
- To get a general idea about the models and architectures of web services
- To discuss about a standardized framework for applications to communicate over the internet.

Outcome:

The student will be able to

- design and launch Web services.
- employ web service architectures and will able to use the corresponding standards like WSDL, SOAP, UDDI and RPC for developing web applications.
- develop registration and discovery techniques for Web services.
- evaluate emerging and proposed standards for the main components of web service architectures.

Evolution of Distributed Computing-Introduction to Web Services-Building the Web Services Architecture-Developing Web Services using SOAP-Description and Discovery of Web Services-Creating .Net Interoperability-Introduction to Java Web Services Developers Pack (JWSDP)-XML Processing and Data Binding with Java APIs-XML Messaging using JAXM and SAAJ-Building RPC Web Services with JAX-RPC–Java API for XML Registers-Using the Java Webs Services Developer Pack: Case Study-Web Services Security-Introduction to SUN ONE.

Reference Books:

1. Ramesh Nagappan, Robert Skoczylas and Rima Patel Sriganesh, Developing JavaWeb Services, Wiley Publishing Inc, 2008, ISBN 10:81-265-0499-4/ISBN 13:978-81-265-0499-2.
2. Sandeep Chatterjee, James Webber,Developing Enterprise Web Services, Pearson Education, 2007,ISBN: 81-317-1317-2
3. Steve Graham,Doug Davis, et al.,Building Web Services with Java, Pearson Education,2008,ISBN:81-317-1813-1.
4. Martin Kalin, Java Web Services, O'reilly Publications, 2009, ISBN: 978-0-5916-52112-7.
5. Robert Daigneau, Service Design Patterns: Fundamental Design Solutions for SOAP/WSDL and RESTful Web Services, PearsonEducation, 2011, ISBN: 978-0-321-54420-9.
6. G Alonso, Web Services: Concepts, Architectures and Applications, Orient BlackSwan Publications, 2009, ISBN 10: 8184891709 / ISBN 13: 9788184891706.
7. Eric Armstrong, et a , The Java Web Services Tutorial, Pearson Education ,2005, ISBN-10: 0201768119 /ISBN-13: 978-0201768114 .

14CS3060 SEMANTIC WEB

Pre-requisite: 14CS2011 Database Systems

Credits: 3:0:0

Objective:

- To introduce ontologies for representation of semantics in the formalisms
- To explore all available information - display elements, metadata, services, images, and especially content - accessible.

Outcome:

The student will be able to

- gain knowledge on how to enable structural and semantic definitions of documents providing completely new possibilities like, intelligent search instead of keyword matching, document exchange among departments via ontology mappings
- implement XML enabled Electronic commerce which plays a major role in daily life

Introduction to Need for semantic web – SHOE language, DAML-ONT-Ontologies and schema Languages on the Web-UPML-Ontologies Come of Age-Sesame-Enabling Task-Centered Knowledge Support through Semantic Markup-Knowledge Mobility-Complex Relationships for the Semantic Web-Semantic Portal-Semantic Gadgets-Static and Dynamic Semantics of the Web-Semantic Annotation for Web Content Adaptation-Task Achieving Agents on the World Wide Web

Reference Books:

1. Diester Fensel, James Hendler, Henry Lieberman, Wolfgang Wahlster, Spinning the Semantic Web, The MIT Press, 2005, ISBN 0-262-56212-X
2. Jorge Cardoso , Semantic Web Services: Theory, Tools and Applications, Idea Group Pub, 2007,ISBN 9781599040455
3. Toby Segaran, Colin Evans , Jamie Taylor, Programming the Semantic Web, July 21, 2009 ISBN-10: 0596153813,Oreilly
4. Grigoris Antoniou,Paul Groth,Frank van Harmelen, A Semantic Web Primer, Third Edition,2012, ISBN-978-0-262-01828-9
5. Vladimir Geroimenko,Chaomei Chen, Visualizing the Semantic Web: XML-based Internet and Information Visualization,Second Edition,ISBN 1-85233-976-4,Springer-Verlag London Limited,2006
6. Bo Leuf,The Semantic Web,Crafting Infracture for Agency,Wiley 2006,ISBN-13 978-0-470- 01522-3

14CS3061 KNOWLEDGE MANAGEMENT

Pre-requisite: 14CS2011 Database Systems

Credits: 3:0:0

Objective:

- To provide an insight about knowledge, knowledge management system life cycle and technical aspects of knowledge management
- To discuss about knowledge creation and knowledge capture
- To expose the students to ethical, legal and managerial issues in knowledge management
- To examine how tacit knowledge is codified and how the resulting knowledge base is implemented.

Outcome:

The students will be able to

- get an overview about knowledge, knowledge management life cycle and technical aspects of knowledge management
- understand the practical applications of knowledge management initiatives at leading firms and government organizations
- get an exposure to the ethical, legal and managerial issues in knowledge management and its implementation aspects.

Basics of Knowledge Management - Understanding Knowledge – Knowledge Management System Life Cycle - Knowledge Creation and Architecture – Capturing Tacit Knowledge – Other Knowledge Capturing Techniques - Knowledge Codification – System Testing and Deployment – Knowledge Transfer and Knowledge Sharing – Knowledge Transfer in the E-World - Learning From Data – Data Mining - Knowing the Unknown – KM Tools and Knowledge Portals - Ethical, Legal and Managerial Issues

Reference Books:

1. Elias M. Awad and Hassan Ghaziri, “Knowledge Management”, Pearson Education India, 2008, ISBN 978-81317-140-34.
2. Irma Becerra-Fernandez and Rajiv Sabherwal, "Knowledge Management: Systems and Processes" M.E. Sharpe Inc.,2010, ISBN: 978-0-7656-2351-5.
3. Shelda Debowski, "Knowledge Management: A Strategic Management Perspective" John Wiley and Sons, Australia, 2006 ISBN-10: 0470805382
4. Kimiz Dalkir, "Knowledge Management in Theory and Practice", Elsevier Inc. 2005, ISBN-13: 978-0262015080
5. Stuart Barnes, “Knowledge Management Systems: Theory and Practices”, Thomson Learning, 2002, ISBN: 1-86152-616-4

14CS3062 ROUTING AND SWITCHING TECHNOLOGIES

Credits: 3:0:0

Objectives

- To learn the virtual LAN concepts and its applications.
- To get exposure into Switch Management and Network Troubleshooting Strategies.
- To understand the most popular routing protocols - RIPv1 and RIPv2, EIGRP, OSPFv2.
- To know the route redistribution and on-demand routing.

Outcome:

The students will be able to

- analyze, Configure, troubleshoot and maintain the dynamic routing protocols: RIP, EIGRP and OSPF.
- demonstrate route redistribution and on-demand routing concepts.
- configure and troubleshoot VLAN and optimize their performance.

Routing Basics: TCP/IP Review, IPv6 Overview, Static Routing , Dynamic Routing Protocols , Interior Routing Protocols: Routing Information Protocol (RIP), RIPv2, RIPng, and Classless Routing, Enhanced Interior Gateway Routing Protocol (EIGRP), OSPFv2, Route Control and Interoperability: Route Redistribution, Default Routes and On-Demand Routing, LAN Switching: Transparent Bridges, Bridging Between Technologies, Principles of LAN Switches, Loop Resolution, Source Routing, Advanced LAN Switch Concepts: Full Duplex Operation, LAN and Switch Flow Control, Link Aggregation, Multicast Pruning, Virtual LANs: Applications and Concepts, Virtual LANs: The IEEE Standard, LAN Security, Switch Management, Network Troubleshooting Strategies.

Reference Books

1. Rich Seifert, James Edwards, The All-New Switch Book - The Complete Guide to LAN Switching Technology, Second edition, Wiley publication, 2008, ISBN:978-1-4571-2740-3
2. Barnes D, Cisco LAN Switching Fundamentals Pearson Education, 2008, ISBN: 9781587058493
3. Stephen A. Thomas, IP Switching and Routing Essentials: Understanding RIP, OSPF, BGP, MPLS, CR-LDP, and RSVP-TE, Wiley publication, 2001, ISBN: 978-0-471-03466-7
4. Jeff Doyle, Routing TCP/IP Volume-1, Second edition, Pearson Education Singapore Pvt Ltd, 2006, ISBN: 9788131700426
5. Bruce Hartpence, Packet Guide to Routing and Switching, O'Reilly Media, 2011, ISBN: 9781449306557

14CS3063 ARTIFICIAL INTELLIGENCE FOR GAMES

Credits: 3:0:0

Objective:

- To impart knowledge about the fundamentals of intelligent behavior and decision making by machines in games
- To cover a wide range of artificial intelligence (AI) techniques to design games.

Outcome:

Students will be able to

- understand the basic concepts of decision making by machines in games
- apply the AI techniques for designing games

Introduction to Artificial Intelligence - Model of Game AI - The complexity fallacy - The Kind of AI in Games- Movement Techniques - Steering Behaviors - Combining Steering Behaviors- Jumping - Coordinated Movements- Movement in Third Dimension - Path finding- Decision trees- Goal-oriented behavior - Rule-based systems - Decision tree learning- Reinforcement learning- Board Games - Designing Game AI - AI Based Game Genres

Reference Books:

1. Ian Millington, John Funge, "Artificial intelligence for Games", Second edition, Morgan Kaufmann Publishers, CRC Press, 2009, ISBN: 9780123747310
2. Stuart Jonathan Russell, Peter Norvig Russell, "Artificial Intelligence – A Modern Approach", Second Edition, Prentice Hall, 2010, ISBN: 9780136042594.
3. Elaine Rich, Kevin Knight, "Artificial Intelligence", Tata McGraw-Hill, 2004. ISBN: 9780070087705
4. Dan W Patterson, "Introduction to AI and Expert Systems, Prentice Hall, 2001. ISBN:81-203-0777-1
5. John B. Ahlquist, Jeannie Novak, "Game Development Essentials: Game Artificial Intelligence", Thomson- Delmar Learning, 2008, ISBN: 9781418038571
6. David M. Bourg, Glenn Seemann, "AI for Game Developers", O'Reilly Series, 2004, ISBN: 9780596005559
7. Richard Rouse, "Game Design: Theory and Practice", Second Edition, Jones and Bartlett Learning, 2010, ISBN: 9781449633455

14CS3064 NETWORK SECURITY

Credits: 3:0:0

Objective:

- Explain the basic concepts in network security.
- Introduce the fundamental techniques in implementing secure network communications.

Outcome:

The students will be able to:

- understand the concepts related to applied cryptography, including authentication, Intrusion detection, digital signatures, etc.
- identify the probable threats and mechanisms to protect against the threats.
- identify the requirements of security for real time applications such as for email and other web based applications

Message authentication – overview of authentication systems - Kerberos – electronic mail security – IP security – web security – network management security – intrusion detection – firewall design principles – trusted systems – trusted operating system design - database and data mining security

Reference Book

1. William Stallings, "Network Security Essentials Applications and Standards", 5th edition, Prentice Hall, 2013, ISBN-13: 978-0133370430.
2. William Stallings, "Cryptography and network security", 5th edition, Prentice Hall, 2011, ISBN-13: 978-0136097044
3. Charlie Kaufman, Radia Perlman, and Mike Speciner, "Network Security: PRIVATE Communication in a Public World", 2nd edition, reprint 2008, Prentice Hall, ISBN-13: 978-0130460196.
4. Jan L. Harrington, "Network Security: A Practical Approach", Morgan Kaufmann Publishers, reprint 2006, ISBN-13: 978-0123116338.

14CS3065 BIG DATA ANALYTICS

Pre-requisite: 14CS2011 Database Systems

Credits: 3:0:0

Objective:

- To provide knowledge about big data and its applications
- To provide an in- depth knowledge of building data models and frameworks and to evaluate model's quality
- To provide basic concepts of graph mining and algorithm

Outcome:

Student will be able to

- build data models, frameworks on big data
- understand research issues in Big data and in graph mining

Introduction to big data – characteristics – sources – phases of big data analytics – big data analytics applications – Architecture Components – The Cloud and Big Data – Predictive analytics – Crowdsourcing Analytics - Open Source Technology for Big Data Analytics –Introduction to Graph data - graph data management algorithms – graph mining algorithms – graph applications - Operations on graph structures – graph query language – feature based graph index – structure similarity search - node clustering algorithm – clustering graphs as objects.

Reference Books:

1. Dr. Aravind sathi , "Big data analytics" IBM Corporation (2012) ISBN – 978 – 1 – 58347 – 380 – 1

2. Charu C Aggarwal , Haixun Wang "Managing and mining graph data" Springer (2010) ISBN – 978 – 1 – 4419 – 6044 – 3
3. Michael Minelli , Michele Chambers, Ambiga Dhiraj, "Big Data, Big Analytics: Emerging Business Intelligence and Analytic Trends for Today's Businesses", Wiley CIO Series, (2013) ISBN: 978-1-118-14760-3.
4. Thomas A. Runkler , " Data Analytics – models and algorithms for Intelligent data analysis" Springer (2012) ISBN – 978 – 3 – 8348 – 2589 – 6
5. Diane J. Cook, Lawrence B. Holder " Mining Graph data" John Wiley and Sons (2007) ISBN – 978 – 0 – 471 – 73190 – 0
6. Jay Liebowitz, "Big Data and Business Analytics", CRC Press, Taylor and Francis Group (2013), ISBN-978-1-4822-1851-0
7. Paul Zikopoulos, Chris Eaton, Understanding Big Data: Analytics for Enterprise Class Hadoop and Streaming Data, Mc Graw Hill Publishers, (2011), ISBN – 978-0-07-179054-3

14CS3066 IP TELEPHONY

Credits: 3:0:0

Objective:

- To learn the basics of Voice over IP (VoIP)
- To understand the protocols that support VoIP
- To provide an overview of interconnection practices in PSTN

Outcome:

Student will be able to

- get detailed knowledge on call setup using each major competing technology
- get detailed guidance on how to implement VoIP interconnect services

Introduction- VoIP Protocols and Global IP Telephony Reachability - Fixed and Mobile VoIP – IP Multimedia Subsystem- Telecoms and Internet converged Services and Protocols for Advanced Networks (TISPAN) Overview - Interconnection Practices in PSTN – roaming in mobile networks- GPRS networks- interconnection requirements and business model- VoIP interconnection models - Implementation Models- VoIP Security Best Practices.

Reference Books:

1. Mohamed Boucadair, Isabel Borges, Pedro Miguel Neves, Olafur Pall Einarsson, IP Telephony Interconnection Reference: Challenges, Models, and Engineering**,** CRC Press, 2012, ISBN 1-46651-298-9
2. Olivier Hersent, Jean-Pierre Petit, David Gurle, Beyond VoIP Protocols: Understanding Voice Technology and Networking Techniques for IP Telephony, John Wiley and Sons, 2005, ISBN 0-47002-363-5
3. Kevin Brown, IP Telephony Unveiled, CISCO Press, 2004, ISBN 1-58720-075-9.
4. Ted Wallingford , Switching to VoIP, O'Reilly Media, Inc.,2005, ISBN 0-59600-868-6
5. James F. Ransome, John Rittinghouse ,VoIP Security, Digital Press, 2005 ISBN 0-08047-046-7
6. Stephanie Carhee, The Road to IP Telephony: How Cisco Systems Migrated from PBX to IP Telephony, Cisco Press,2004 ISBN 1-58720-088-0
7. Bill Douskalis, IP Telephony: The integration of Robust VoIP Services, Pearson Education, 2002, ISBN: 81-7808-285-3

14CS3067 SOFT COMPUTING

Credits: 3:0:0

Objectives:

- To familiarize with soft computing concepts.
- To introduce the ideas of Neural Networks, fuzzy logic and use of heuristics based on human experience.
- To introduce the concepts of Genetic algorithm and its applications to soft computing using some applications.

Outcomes:
Students will be

- able to gain basic knowledge on soft computing and in depth knowledge on Neural Networks.
- equipped with basic knowledge of fuzzy set theory and its impact on fuzzy system Design, genetic algorithm approach and the soft computing applications.

Neural Networks, Artificial Neural Networks, Supervised Learning Networks - Associative Memory Networks, Unsupervised Learning Networks, Special Networks - Fuzzy set Theory - Fuzzy Systems - Fundamentals of Genetic Algorithms, Genetic Modeling, Applications of Soft Computing

Reference Books:

1. S.N. Sivanandan and S.N. Deepa, Principles of Soft Computing, Wiley India, 2008. ISBN:8126510757
2. S. Rajasekaran and G.A.V.Pai, Neural Networks, Fuzzy Logic and Genetic Algorithms, PHI, 2011, ISBN: 978-81-203-2166-1.
3. Timothy J.Ross, Fuzzy Logic with Engineering Applications, McGraw-Hill, 1997.
4. J.S.R.Jang, C.T.Sun and E.Mizutani, Neuro-Fuzzy and Soft Computing, PHI, 2004, Pearson Education.

14CS3068 EVOLUTIONARY COMPUTING

Credits: 3:0:0

Objective:

- To provide basic knowledge about the class of evolutionary methods used in solving computer science problems.
- To study genetic algorithms, evolutionary strategies, genetic programming, problem representations, genetic operations, theory of evolutionary algorithms.
- To understand various approaches and applications of evolutionary computation to combinatorial optimization problems.

Outcome:
Students will be able to

- learn to apply evolutionary computation to combinatorial optimization problems.
- obtain sound knowledge in genetic programming.

Introduction- Evolutionary Algorithm – Components of Evolutionary Algorithms –Evolutionary Computing and Global Optimization – Genetic Algorithms-Evolution Strategies: –Evolutionary Programming – Genetic Programming-Learning Classifier Systems - Parameter Control in Evolutionary Algorithms – Multi-Modal Problems and Spatial Distribution-Hybridization with Other Techniques: Mimetic Algorithms – Theory – Constraint Handling-Special Forms of Evolution: Working with Evolutionary Algorithms.

Reference Books:

1. E. Eiben and J. E. Smith, "Introduction to Evolutionary Computing", Springer – Natural Computing Series, 2nd edition,2007. ISBN: 978-3-540-40184-1.
2. N. Nedjah, E. Alba, L. de. Macedo Mourelle, "Parallel Evolution Computation", Springer Natural Computing Series, 2006. ISBN-10: 3-540-32837-8.
3. Kenneth A. De Jong, "Evolutionary Computation: A Unified Approach", MIT Press, 2006. ISBN-10:0-262-04194-4
4. Riccardo Poli, William B. Langdon and Nicholas Freitag McPhee, A Field Guide to Genetic Programming, Springer, March 2008. ISBN : 978-1-4092-0073-4
5. Kenneth A. De Jong , Evolutionary Computation: A Unified Approach, Mit Press, 2006, ISBN 0262041944

14CS3069 COMPUTER VISION

Credits: 3:0:0

Objective:

- To understand the concepts in computer Vision.
- To provide Knowledge on basic geometry, physics of imaging and probabilistic techniques.

Outcome:

Students will be able to

- understand of Image Formation, Camera models and Parameters, Multiple View Geometry and Segmentation.
- apply Various Filters in practice.

Image Formation And Image Model Geometric Camera Models, Geometric Camera Calibration - Radiometry Measuring Light, Color - Linear Filters, Edge Detection, Texture - The Geometry Of Multiple Views, Stereopsis, Affine Structure From Motion Projective Structure From Motion Segmentation By Clustering, Segmentation By Fitting A Model, Segmentation And Fitting Using Probabilistic Methods

Reference Books:

1. David A.Forsyth, Jean Ponce, Computer Vision A Modern Approach, Second edition,Pearson Education Limited, 2011, ISBN 013608592X,9780136085928
2. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 2010, ISBN: 1848829353, 9781848829350
3. Linda G. Shapiro, George C. Stockman , Computer Vision, Prentice Hall publications, 2001, ISBN 0130307963, 9780130307965
4. Dana H. Ballard, Christopher M. Brown, Computer Vision, Prentice Hall publications, 2003, ISBN:13:9780131653160 ISBN: 0131653164
5. S. Nagabhushana, Computer Vision and Image Processing, New Age International, 2005, ISBN: 812241642X, 9788122416428

14CS3070 QUANTUM COMPUTING

Credits: 3:0:0

Objective:

- To understand the quantum model of computation and how it relates to quantum mechanics.

Outcome:

Students will be able to

- apply quantum models in computing

Introduction - Qubits, Quantum Mechanics and Computer Perspectives – Quantum Gates - Applications- Quantum Teleportation, Quantum Communication - Probabilistic Quantum Algorithms-Algorithm with Super Polynomial Speedup- Eigen Value Estimation- Finding Discrete Logarithms – Hidden Subroots-Algorithm Based on Amplitude Amplification- Grover's Quantum Search Algorithm – Amplitude Amplification - Quantum Amplitude Estimation and Quantum -Quantum Error Correction - Classical Error Correction - Three and Nine- Qubit Quantum Codes - Fault Tolerant Quantum Computation.

Reference Books:

1. Vishal Sahni, Quantum Computing, Tata McGraw-Hill, 2007. ISBN-13: 978-0-07-065700- 7, ISBN-10: 0-07-065700-9.
2. Phillip Kaye, Raymond Laflamme, An Introduction to Quantum Computing, Oxford University Press, 2007. ISBN-10: 0-19-85700-07, ISBN-13: 978-0-19-857000-4.

3. Michael A. Nielsen, Isaac L. Chuang, Quantum Computation and Quantum Information ,Cambridge University Press,10th anniversary edition, December 2010. ISBN-10: 0-52-16350-39, ISBN-13: 978-0-52-163503-5.
4. Willi-Hans Steeb, Yorick Hardyi World Scientific, 2006. ISBN-10: 9-81-25674-02, ISBN-13: 978-9-81-256740-6.
5. Mika Hirvensalo, Quantum Computing, Springer, 2004, ISBN - 3540407049

14CS3071 PERVASIVE COMPUTING

Credits: 3:0:0

Objective:

- To gain an insight into future developments in the field of pervasive computing.
- To provide an in depth knowledge on pervasive computing and wireless networking.
- To describe the variety of pervasive services and applications.

Outcome:

Students will be able to

- learn pervasive services and applications.

What Pervasive Computing Is All About-Devices: Information Access Devices-Embedded Controls-Entertainment Systems - Operating Systems-Middleware Components-Mobile Internet –Connectivity-Service Discovery-Gateways-Application Servers-Internet Portals-Device Management-Synchronization-Home services-Travel Services-Business Services-Consumer Services

Reference Books:

1. Uwe Hansmann, Lothar Merk, Martin S. Nicklous, Thomas Stober, Pervasive Computing Handbook, Springer, 2001, ISBN 3-540-6712.
2. Asoke K Taukder, Roopa R Yavagal, "Mobile Computing", Tata McGraw Hill Pub Co., New Delhi, 2005
3. Asoke K Talukder, Roopa R Yavagal, Mobile computing: Technology, Applications andService Creation, Tata McGraw-Hill Publishing Company Limited, 2005, ISBN 0 – 07 -.058807 – 4.

14CS3072 PARALLEL COMPUTING

Credits: 3:0:0

Objective:

- To provide a complete end-to-end source on almost every aspect of parallel computing.
- To explain both traditional computer science algorithms as well as scientific computing algorithms.
- To explain MPI, Pthreads and Open MP, the three most widely used standards for writing portable parallel programs.

Outcome:

Students will be able to

- learn MPI, Pthreads and Open MP, the three most widely used standards for writing portable parallel programs

Introduction to parallel computing – Parallel programming platforms-parallel algorithm design and basic communication- Principles of parallel algorithm design – Basic communication –Programming- Programming using the message-passing paradigm – Programming shared address space-algorithms- Dense matrix algorithms – Graph algorithm-Searching and sorting- Search algorithm for discrete optimization problems – Sorting.

Reference Books:

1. Ananth Grama, Anshul Gupta, George Karypis, Vipin Kumar, Introduction to Parallel Computing, Second Edition, Reprint 2012, Pearson Education, ISBN-13: 9788131708071

2. Roman, Peter, Parallel Computing: Numerics, Applications, and Trends, 2010, ISBN-13: 9781849968416
3. Michael J. Quinn, Parallel Computing: Theory and practice, Second edition, Reprint 2008, Tata McGraw – Hill Education, ISBN-13: 9780070495463
4. Peter Arbenz, Wesley Petersen, W.P. Petersen, Introduction to Parallel Computing, 2008, Oxford, ISBN-13: 9780199560868

14CS3073 WEB SECURITY

Credits: 3:0:0

Objective:

- To have a wide understanding of the various threats in the internet.
- To gain knowledge about security threats at user and sever level, transaction level.
- To know about commerce and legal issues in the web.

Outcome:

Students will be able to

- apply the correct security measures for each threat.
- design mechanisms to securely transfer information from the sender to the receiver.

Introduction to web security: World Wide Web Architecture, Threats, Landscape, User Security, Server Security, Data Security, Cryptography and the Web-User level security: Privacy-protection Techniques and Technologies, Backup and Antitheft, Plugins, JavaScript, Flash, Digital Certificates – Server and Client, Code Signing-Server level security: Physical security, Host security, SSL certificates, Web Service Security, Web Application Security, Secure Programming-Transaction level security and security infrastructure: SSL/TLS protocol, Secure Authentication and Messaging, Public Key Infrastructure, Firewallsolutions, Intrusion Detection System, Disaster Recovery and Backups-Commerce and legal issues: Digital Payments, Blocking Software and Censorship Technologies, Legal issues: Civil and Criminal, Intellectual Property and Actionable Content.

Reference Books:

1. Simpson Garfinkel, Gene Spafford, Web Security, Privacy and Commerce, O'Reilly, Second Edition, 2002. ISBN: 978-0-596-00045-5.
2. ShwetaBhasin, Web Security Basics, Premier Press, 2003. ISBN: 1-59200-006-1.
3. Simpson Garfinkel, Eugene H. Spafford, Web Security and Commerce, O'Reilly, First Edition. ISBN:1-56592-269-7.

14CS3074 ADVANCED DATA MINING

Prerequisite: 14CS2011 Database Systems

Credits: 3:0:0

Objective:

- To provide an in-depth knowledge of data mining concepts, algorithms and performance measures
- To get an insight of efficiency of data mining algorithms in solving practical problems
- To provide hands-on experience in commercial data mining tools

Outcome:

The student will be able to

- apply the relevant data mining algorithms for practical problems
- measure the performance of the designed system.

Introduction to Data Mining : Overview - Techniques and Tools - Applications –-Knowledge Representation: Input Knowledge – Output Knowledge – Case Study - Data Preprocessing : Cleaning – Transformation – Reduction – Discretization – Case Study – Attribute Oriented Analysis – Case Study using filters – Data Mining Algorithms : Association Rules – Classification Rules – Prediction - Clustering - Training and Testing Data - Performance

Measures - Development of Practical Applications using Data Mining Algorithms – Advanced Data Mining Techniques : Text Mining, Web Mining

Reference Books:

1. Jiawei Han, Micheline Kamber, Data Mining Concepts and Techniques, Chris Ullman, Morgan Kaufmann Publishers,Third Edition, 2011, ISBN 0123814790, ISBN-13 9780123814791.
2. Ian H. Witten, Eibe Frank, Data Mining Practical Machine Learning Tools and Techniques,Elsevier, Third Edition, 2011, ISBN: 978-012-374856-0.
3. David Hand, Heikki Mannila and Padhraic Smyth, Principles of Data Mining, The MIT Press, 2001. ISBN-10: 026208290X
4. Max Bramer, Principles of Data Mining, Springer, 2013 ISBN -1447148843
5. Bertrand Clarke, Ernest Fokoue, Hao Helen Zhang, Principles and Theory for Data Mining and Machine Learning, Springer, 2009, ISBN-0387981357

14CS3075 WIRELESS SECURITY

Credits: 3:0:0

Objectives:

- To provide exposure to various threats in wireless networks and security solutions.
- To understand the technologies and protocols that support security in wireless networks.

Outcome:

Students will be able to

- gain and in-depth understanding of the development of Wireless Security and its related attacks.
- learn about the technologies and protocols that makes up real secured wireless Network.

Introduction- security principles and attacks - Wi-Fi Vulnerabilities to attack – Different Types of Attack – Wireless Information warfare - IEEE 802.11 Protocol Primer- IEEE 802.11 WEP Working and non-working - WPA, RSN and IEEE 802.11i-Access Control: IEEE 802.1X, EAP, and RADIUS - Upper Layer Authentication - WPA and RSN Key Hierarchy- TKIP - AES CCMP - Wi-Fi LAN Coordination: ESS and IBSS- Public Wireless Hotspots - Securing Wireless LAN - Wireless Application Protocol – Bluetooth Security – VoIP Security.

Reference Books:

1. Jon Edney, William A. Arbaugh, Real 802.11 Security Wi-Fi Protected Access and 802.11i, Pearson Edition, Reprint 2007, ISBN: 0321136209.
2. Randall K.Nichols, Panos C. Lekkas, Wireless Security: Models, Threats and Solutions, Tata McGraw Hill, 2006. ISBN: 0-07-061884-4.
3. Merrit Maxim, David Pollino, Wireless Security, McGraw-Hill, 2002, ISBN: 0-07-222286-7.

14CS3076 CYBER FORENSICS

Credits 3:0:0

Objective:

- In-depth understanding of cyber forensics and its application to real time scenarios
- Gain knowledge on the legal issues of performing digital forensic.

Outcome:

The students will be able to

- understand the diversity and effect of cybercrime.
- collect digital forensic evidences and to analyze and investigate the contents.
- understand the nature of cyber terrorism and its effects.

The cyber crime - Forensic Computing: Collection, investigation and examination of digital evidence - Crime related to unauthorized access: Hacking - cyber crimes in financial activities - cyber terrorism – mobile and wireless technology: new playgrounds for cyber criminals - The computer and Internet security - Forensics Investigation, response – Security issues with outsourcing – the nondisclosure agreement – myths about outsourcing security - Security Service level agreements - Future trends in security

Reference Books:

1. R. K. Chaubey, "An Introduction to cyber crime and cyber law", Kamal Law House, second edition 2012.
2. John W. Rittinghouse, William M. Hancock, "Cybersecurity Operations Handbook", ISBN-13: 978-1555583064, 2005.
3. John R. Vacca, "Computer forensics: Computer Crime Scene Investigation", 2nd Edition, Charles River Media, Inc. Boston, 2005, ISBN-13: 978-1584503897.
4. Nina Godbole, Sunit Belapure, "Cyber security: understanding cyber crimes, computer forensics and legal perspectives", Wiley India Pvt. Ltd., 2011, ISBN-13: 978-8126521791.
5. Raghu Santanam, M. Sethumadhavan, "Cyber Security, Cyber Crime and Cyber Forensics: Applications and Perspectives", Idea Group Inc (IGI), 2011, ISBN: 9781609601256

14CS3077 ELEMENTS OF MULTIMEDIA SYSTEMS

Credits 3:0:0

Objective:

- To learn the basic components of multimedia
- To understand the fundamentals of media components such as audio, video and images
- To learn and understand the need of data compression
- To understand various compression methods
- To understand colour schemes in multimedia
- To learn the fundamentals of storage mechanisms in multimedia

Outcome:

Students will be

- equipped with in depth knowledge on components of multimedia, the need of data compression and various compression methods.
- able to know the storage mechanisms and colour schemes in multimedia.

Introduction To Multimedia and Audio Technology - Content Processing - Media and Data Streams-Key Properties of Multimedia System - Audio Technology - Music and MIDI Standard - Graphics and Images - Video Technology - Computer Based Animation - Graphics and Image Data Representations - Colour in Image and Video - Data Compression - Optical Storage Media.

Reference Books:

1. Ralf Steinmetz, Klara Nahrstedt, Multimedia Fundamentals, Pearson Education, Second Edition, 2004. ISBN: 978-81-317-0976-4.
2. Andreas Holzinger, Multimedia Basics, Volume 1, Firewall Media publisher, 2009, ISBN: 8170082439, 9788170082439
3. Ze-Nian Li and Mark S. Drew, Fundamentals of Multimedia, Pearson Education, 2004. ISBN 81-297-0438-2.
4. Jens Ohm, Multimedia Communication Technology, Springer-Verlag, 2004. ISBN: 3-540- 01249-4.
5. Daniel Cunliffe, Geoff Elliott, Multimedia Computing, Lexden Publishing Limited, 2005, ISBN: 1904995055, 9781904995050

14CS3078 MULTIMEDIA COMMUNICATION

Credits 3:0:0

Objective:

- To learn the multimedia communication standards
- To learn about multimedia internet protocols.
- To learn the Multimedia communication across the networks.

Outcome:

Students will be

- equipped with knowledge on implementing the concepts based on multimedia communication standards and internet protocols.
- able to understand multimedia communication and broad band ATM Networks

Multimedia Networks - Standards and Digital Multimedia Communications: IP Datagrams - Fragmentation and Reassembly-IP Addresses- ICMP- QOS Support- IPv6-IPv6/IPv4 Interoperability- Broadband ATM Networks and Entertainment Networks - Transport Protocols - Multimedia Communications across Networks

Reference Books:

1. Fred Halsall, Multimedia Communications, Pearson, Seventh Indian Reprint, 2005. ISBN: 81-7808-532-1.
2. K .R. Rao, Zaron S. Bojkovic, Dragorad A. Milocanovic, Multimedia Communication Systems, Prentice Hall India, 2006. ISBN: 0471656402, 9780471656401.
3. Steve Heath, Multimedia and Communication Technology, Second Edition, Focal Press, 2003. ISBN: 81-8147-145-8.
4. Kumar Krishna, Multimedia Communication, Pearson Education India, 2010. ISBN: 813173238X, 9788131732380.
5. C. T. Bhunia, Multimedia and Multimedia Communication, New Age International, 2009. ISBN: 8122426603, 9788122426601.

14CS3079 INTERNETWORKING LAB

Co-requisite: 14CS3024 Internetworking

Credits: 0:0:2

Objective:

- To simulate TCP/IP protocols using JAVA
- To simulate Virtual LAN, Ethernet and Wireless LAN using Packet Tracer
- To simulate networking routing protocols using Packet Tracer
- To simulate the IP Protocol using Packet Tracer
- To learn trouble shooting of networks using Packet Tracer
- To simulate subnetting and supernetting concepts using Packet Tracer

Outcome:

The student will be able to

- understand the working functionalities of TCP/IP protocols
- understand the functionalities of internetworking Protocols.
- learn about working of different computer networks
- learn about practical idea about subnetting and supernetting concepts.

The faculty conducting the laboratory will prepare a list of 12 experiments and get the approval of HOD/Director and notify it at the beginning of each semester.

14CS3080 EMBEDDED LINUX

Credit: 3:0:0

Objective

- To expose the students to the fundamentals of embedded Linux programming.
- To study the concept of memory management
- To understand the fundamentals of operating system

Outcome:

The student will be able to

- work on basic Linux Programming.
- develop embedded Linux program.
- write programs in real-time systems with memory management.

Fundamentals of Operating Systems :Overview of operating systems , Scheduling, Process Synchronization, Semaphores, Message Passing, Mailboxes, Deadlocks , Synchronization Linux Fundamentals - Embedded Linux, Linux kernel architecture, Board Support Package and Embedded Storage Inclusion of BSP in kernel build procedure, The bootloader Interface, Memory Map, Interrupt Management, PCI Subsystem, Timers, UART, Power Management – Embedded Storage, Flash Map, Memory Technology Device (MTD, Embedded File Systems, Embedded Drivers and Application Porting, I2C subsystem, USB gadgets, Watchdog timer , Kernel Modules , Case studies .

References

1. Dhananjay M. Dhamdhere, "Operating Systems A concept based Approach", Tata Mcgraw-Hill, New Delhi, 2012.
2. Matthias Kalle Dalheimer, Matt Welsh, "Running Linux", O'Reilly, U.K, 2005.
3. P. Raghavan ,Amol Lad , Sriram Neelakandan, "Embedded Linux System Design and Development", Auerbach Publications. London, 2006.
4. Karim Yaghmour, "Building Embedded Linux Systems", O'Reilly, UK, 2008.

14CS3081 REAL TIME UNIFIED MODELING LANGUAGE

Credits: 3:0:0

Objective:

- To study the software designing used in embedded systems.
- To study the object oriented analysis and design for real time systems.
- To study the development activities of real time system using UML.

Outcome:

The student will be able to

- apply Object Structure and Behavior analysis in real time design
- apply the concept of architectural design in practical applications
- apply objects and classes concepts in real time applications

Real Time Systems and Objects**:** Introduction to real time system, Development of ROPES process, Relations among classes and objects, Class diagrams, Use cases, Filling out the details of the use case, Key Strategies for Object Identification, Defining Object Behavior: Object Behavior, Defining object state behavior, UML state charts, The role of scenarios in the definition of behavior, Defining operations, Architectural Design: Overview of design , Architectural design, Architectural patterns, Concurrency design, Representing Threads, Identifying threads

References

1. Bruce Powel Douglas, "Real – Time UML, Second Edition: Developing Efficient Objects for Embedded Systems", 2 edition , Addison – Wesley, 2000 .
2. Peter Coad, Edward Yourdon, " Object Oriented Analysis, First Indian Reprint 2001.

3. Simon Bennett , Steve Mcrobb, Ray Farmer, "Object Oriented Systems Analysis And Design Using UML, Second Edition.,2006
4. Phillip A Laplante , "Real Time Systems Design And Analysis, Third Edition Second Reprint 2006.

14CS3082 REAL TIME OPERATING SYSTEMS

Credits 3:0:0

Objectives:

- To expose the students to the fundamentals of interaction of OS with a computer and user computation.
- To teach the fundamental concepts of how processes are created and controlled with OS.
- To study on programming logic of modeling Process based on range of OS features

Outcomes:

The student will be able to

- understand the programming logic of modeling process
- know the functionalities in commercial OS.
- develop an application using RTOS.

Design and Implementation of processes, Distributed operating system, RTOS Task and Task state –Multithreaded Premptive scheduler- Process Synchronisation. Process Based and Graph based Models – Real Time Languages – RT scheduling - Interrupt processing – Synchronization – Control Blocks – Memory Requirements. Polled Loop Systems – RTOS Porting to a Target – Comparison and Basic study of various RTOS. Applications - Case studies

References:

1. Silberschatz,Galvin,Gagne" Operating System Concepts,6thEdition,John Wiley,2003
2. D.M.Dhamdhere," Operating Systems,A Concept-Based Approch,TMH,2008
3. Raj Kamal, "Embedded Systems- Architecture, Programming and Design" Tata McGraw Hill, 2006.
4. Herma K., "Real Time Systems – Design for distributed Embedded Applications", Kluwer Academic, 1997.
5. Charles Crowley, "Operating Systems-A Design Oriented approach" McGraw Hill 1997.
6. C.M. Krishna, Kang, G.Shin, "Real Time Systems", McGraw Hill, 1997.
7. Raymond J.A.Bhur, Donald L.Bailey, "An Introduction to Real Time Systems", PHI 1999.
8. MukeshSighal and N G Shi "Advanced Concepts in Operating System", McGraw Hill 2000.